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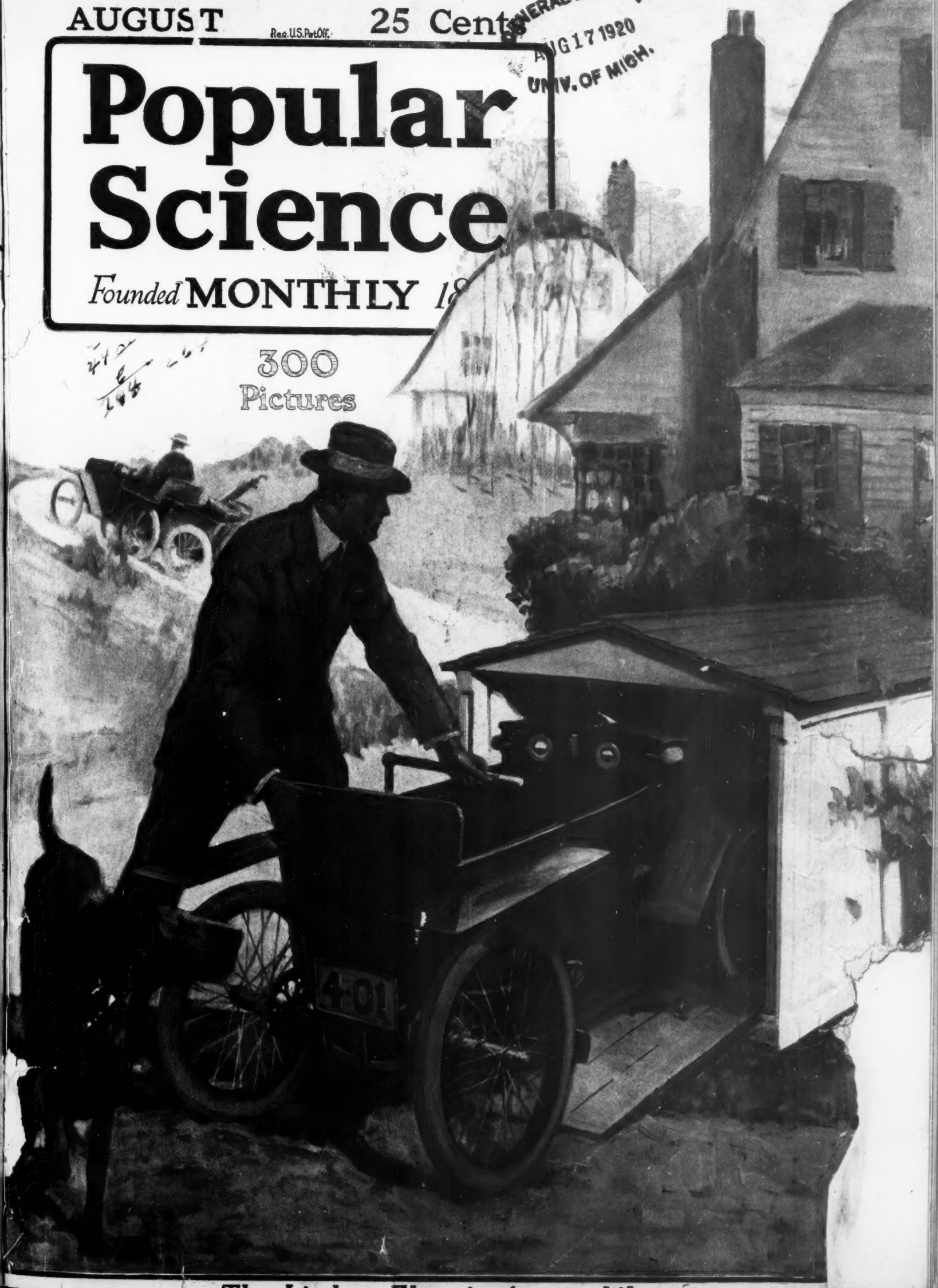

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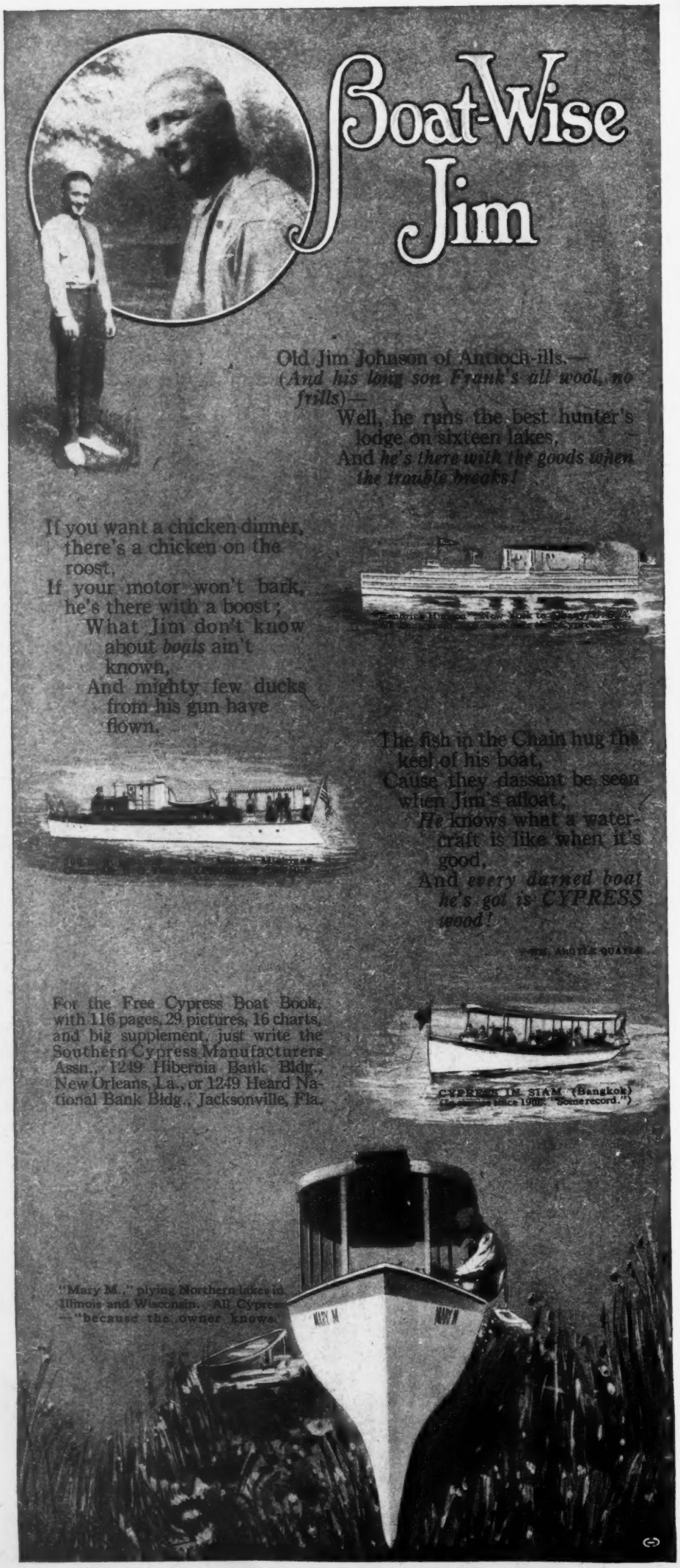
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Popular Science Monthly

AUGUST, 1920

Volume 97-No. 2

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POPULAR SCIENCE MONTHLY is issued monthly. Yearly subscription in the United States, $3.00. Canada, $3.50. Foreign, $4.00. Single copy, 25 cents.

POPULAR SCIENCE MONTHLY may be had at all newsstands in the United States and Canada; also from the International News Company, London, and at Brentano's, Paris.

Advertising rates on application. Forms close the twentieth of the second month preceding date of publication. Entered as second-class matter Dec. 28, 1915, at the Post Office at New York under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Canada.

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H. J. Fisher, President; R. C. Wilson, Vice-President; O. B. Capen, Secretary and Treasurer.

Modern Publishing Company

225 West Thirty-ninth St. New York City

Popular Science Monthly

Waldemar Kaempffert, *Editor*

August, 1920; Volume 97, No. 2
25 Cents a Copy; $3 a Year

Published in New York City at
225 West Thirty-ninth Street

How Much Gas Can You Breathe?

Thousands of automobiles will use the vehicle tubes to be built under the Hudson. What about their exhaust gases?

By Yandell Henderson

Consulting Physiologist, United States Bureau of Mines

IF a man or animal were shut up in a small garage with a four-cylinder car, three cylinders of which were missing, the carbon-monoxide diffused by the one active cylinder would induce death before the three other cylinders had discharged enough unconsumed gasoline to produce by itself slight nausea.

Every automobile driver knows that the products of combustion discharged into the atmosphere by his engine are highly poisonous. But he erroneously attributes their toxicity to vaporized, unburned gasoline and not, as he should, to carbon-monoxide. It is true that gasoline vapor breathed, has an intoxicating, nauseating effect; but it is the carbon-monoxide that is really to be dreaded. Moreover, the combustion of one part of gasoline vapor in an engine produces about two parts of carbon-monoxide — all the more reason why a man should know more about the fumes dis harged by his engine.

What is carbon-monoxide? Every one is more or less familiar with it, not so much in a chemical as in a practical sense; for carbon-monoxide is one of the principal constituents of the smoke from burning buildings, the fumes that rise from coal fires and explosives, and the "after-damp" of explosions of methane and coal dust in mines.

Whenever coal, or for that matter any form of carbon, is burned, carbon-monoxide is generated, to become a dangerous poison unless there is a full supply of air. This gas is responsible for more deaths than all other gases combined. It is the chief constituent of illuminating gas, and to illuminating gas in turn may be traced an unfortunately large number of fatalities in American cities.

Now this deadly carbon-monoxide, which is discharged by automobiles, found in mines, and liberated by coal fires, is itself almost odorless. It has no irritating effect on the lungs. It is peculiarly treacherous and subtle.

While it has no direct effect upon the tissues of the body or even upon the nerves, it impairs the blood. It has an avidity for hemoglobin, the red coloring matter of the blood, in which respect it resembles oxygen; but the avidity with which it combines with hemoglobin is three hundred times greater than that of oxygen. It kills because it reduces the oxygen-carrying power of the blood and not because it forms a permanent compound with hemoglobin. That explains why a man who is only partially overcome by carbon-monoxide need only be carried out into the open air in order to restore the oxygen-carrying capacity of his hemoglobin.

There are, I believe, more than six million automobiles in the United States, not to mention several hundred thousand motor-trucks. All of them discharge into the air exhaust gases containing more or less

To Dr. Yandell Henderson was given the task of finding out how much poison gas a man or a horse can safely take. Suggested plans for ventilating the proposed Hudson river automobile tunnel are based on his investigations

If You Were Shut Up in a Garage with a Car

If you were shut up in a small garage with a four-cylinder car, three cylinders of which are missing, the carbon-monoxide produced by the one active cylinder would kill you.

A tunnel for vehicles of all kinds is to be built under the Hudson river between New York and New Jersey. Riding behind the thousands of automobiles passing through this tunnel, would the accumulation of gases suffocate you?

Professor Henderson here tells the POPULAR SCIENCE MONTHLY readers what he has discovered.

carbon-monoxide. On the open road this is a matter of no moment; but when it was decided to construct tunnels under the Hudson river between New York and New Jersey—tunnels to be used principally by motor-vehicles, trucks, and passenger-cars—it became at once a very practical problem to find out how far the air in a confined space may safely be polluted by carbon-monoxide.

Other Tunnels Are Planned

Boston is planning to bring East Boston and the summer resorts nearer to its citizens by constructing similar tunnels under the harbor, and vehicular tunnels are said to be under consideration in New Orleans where the Mississippi river checks travel. Lord Ashfield recently proposed that London should seek to relieve its congestion by constructing underground tubes for its motor- and horse-drawn vehicles.

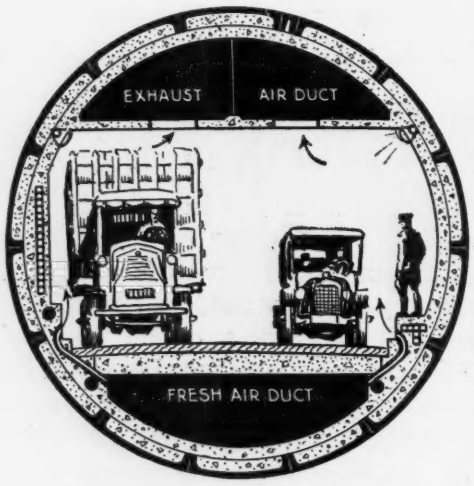
To carry out these undertakings without first providing safe ventilation would certainly be reckless. Curiously enough, a systematic, scientific study of the effect of carbon-monoxide under conditions that would prevail in a vehicular tunnel has never been made. The conditions in coal-mines and in gas-producing plants have been studied, but the results recorded apply only to healthy workingmen. Tunnels for vehicles will be used by the general public—by healthy adults, children, and even invalids on their way to the hospital. Many thousands of automobiles and motor-trucks will discharge exhaust gas into the Hudson river tunnels. The length of the proposed tunnels from portal to portal is 8,500 feet and the distance between the ventilating shafts at the pier heads on the two sides of the river is to be about 3,600 feet. No tunnel of these dimensions has yet been constructed for motor transportation. Passenger-cars are expected to travel through the tunnel at the rate of ten or fifteen miles an hour, making the trip in ten minutes; slower motor-trucks in half an hour. Two lines of traffic abreast will pour in a constant stream through each of the two tubes. Yet no serious blockade can occur; for if a car breaks down the vehicles behind will pass around it, and an automobile derrick will always be on hand to remove it.

It might be argued that a powerful blower system which would always scavenge the tunnels and insure a constant supply of fresh air could be installed. But engineers tell us that such a blower system would be extremely expensive, and, moreover, that a veritable gale would have to sweep through each tunnel to remove the gases. No one would care to use the tunnels if a hurricane had to be encountered when passing through them.

The tunnels must be ventilated in the least expensive and the least objectionable way. The thousands of men and women who will daily pass back and forth through the tunnels must not suffer from headaches as the result of breathing exhaust gas. First of all, the human equation must be considered.

Measuring the volume of a man's breath in order to determine the amount of gas-charged air he takes in with each respiration

As we have said, there is much information on carbon-monoxide, but it does not cover the problems of the engineers who will construct the tunnel. Dr. J. S. Haldane, an eminent English authority, scientifically considered the safety of miners after mine explosions and fires; but he was concerned chiefly with determining the amount of gas which would incapacitate or seriously inconvenience a man, rather than with the amount which would be compatible with perfect comfort and efficiency. Accordingly, the bridge and tunnel commissions of the states of New York and New Jersey through Mr. Clifford M. Holland, their chief engineer, requested Mr. Van H. Manning, Director of the United States Bureau of Mines, to make a scientific investigation which would determine, first, the amount and character of the exhaust gas expelled by various types and sizes of motor-trucks and passenger-cars, and second, the nature of the poisonous substances and their allowable concentrations. Since the writer had previously had experience in conducting research on the physiological effect of gases, he was asked by Director Manning to find out to what extent exhaust gas must be diluted with air to be rendered practically harmless for short periods.



The proposed system of ventilation includes a fresh-air duct below and an exhaust-air duct above. Fans at the side distribute the fresh air. Suction above expels the stale air

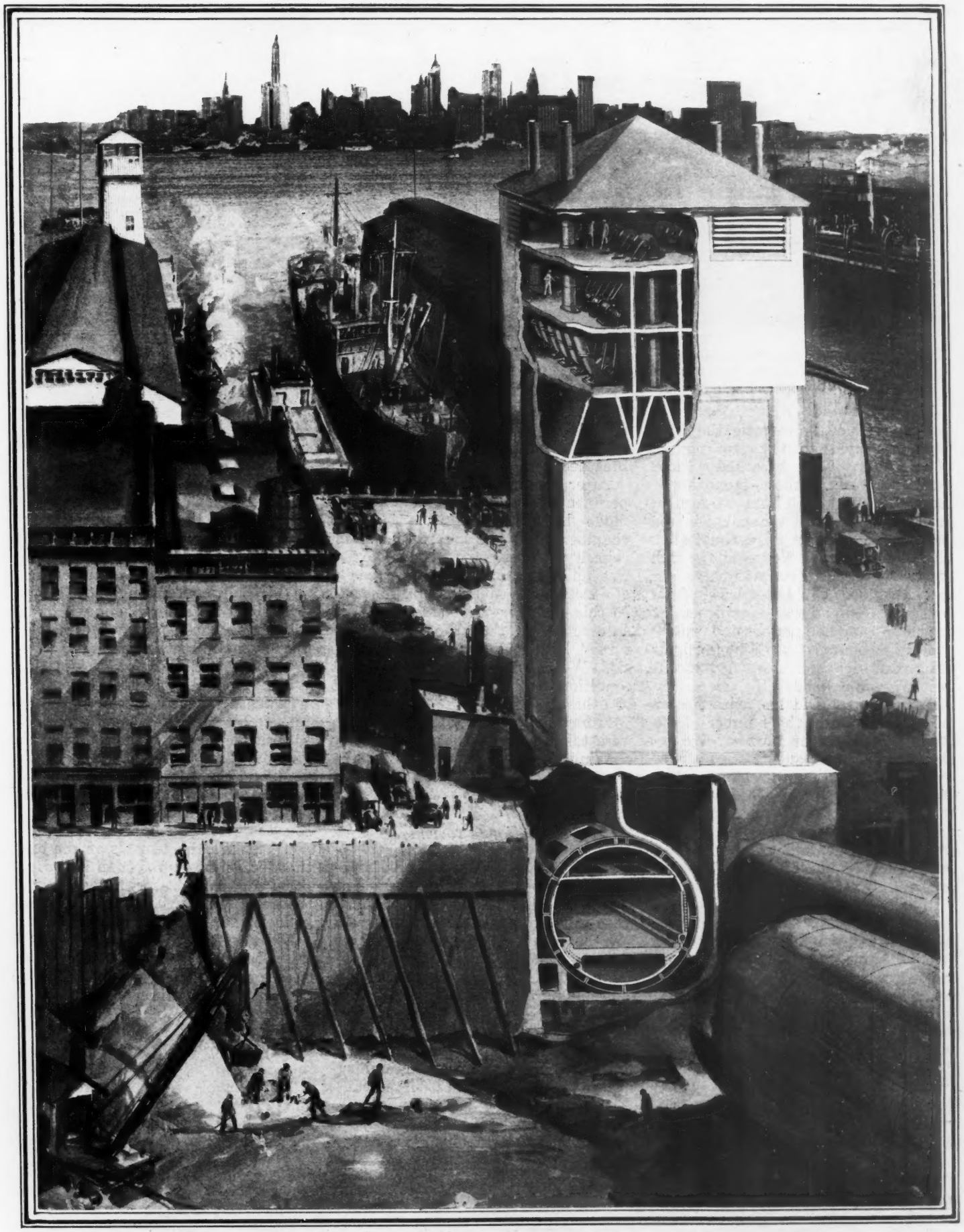
Gasoline Affects a Man Like Ether

A gasoline engine exhausts carbon-dioxide, carbon-monoxide, water vapor, a little hydrogen, and some unburned fuel. Of these, the carbon-monoxide is the most important. Hence, the investigation was confined largely to a study of its poisonous effect.

We found in the laboratory at Yale University that gasoline vapor affects an animal much as ether will. That is, it acts as an anaesthetic. Unlike ether, it irritates the cerebral cortex—the outer covering of the brain. A man under the influence of ether is often excited; but gasoline vapor induces also violent convulsions. Between consciousness and death there is but a short gap when an animal is brought under the influence of gasoline.

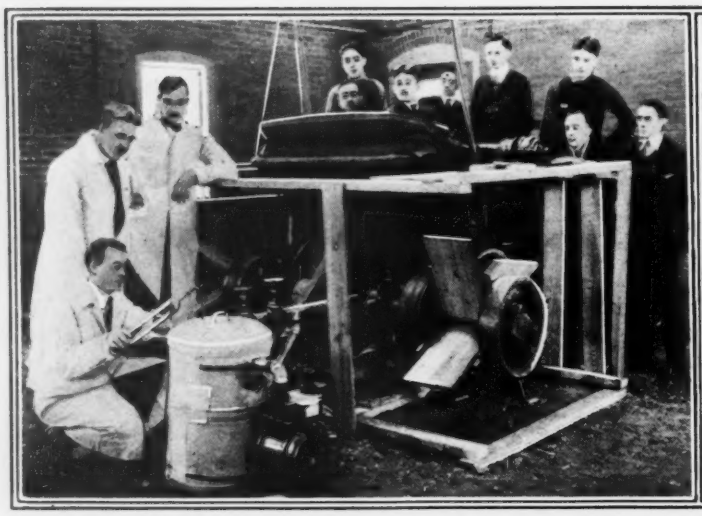
But a more important matter to determine was, what percentage of carbon-monoxide may be present in the air of tunnels without causing injury. How much carbon-monoxide may be absorbed without producing appreciable discomfort? That was the first question that we had to answer. At what rate will the driver of a car or a truck absorb carbon-monoxide in various parts of the New York-New Jersey tunnel? That was the second question to be answered—important, because the amount of carbon-monoxide would not be the same everywhere in the tunnels. What is the influence of any physical exertion upon the volume of the breathing and then upon the rate of absorption of carbon-monoxide? That became the third question to be answered. And, lastly, all this physiological information had to be expressed in some form which would enable the engineers to design a proper ventilating system.

First of all, we built a little chamber of six cubic meters capacity—roughly five and a half by six by seven feet. We made it gastight. In this cham-

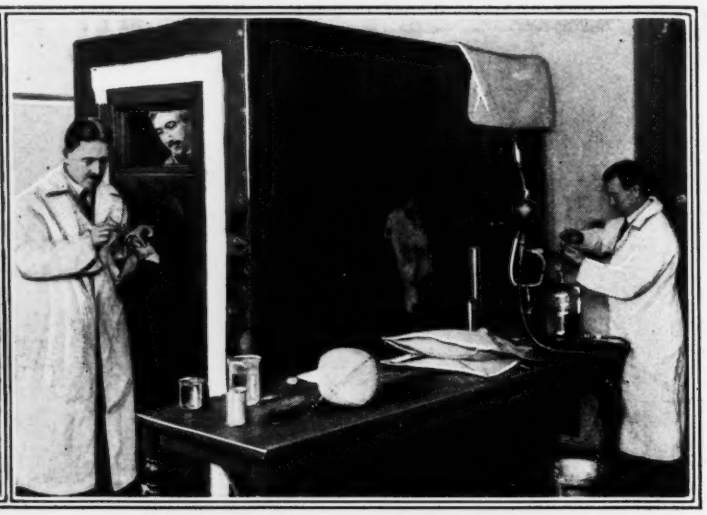


How They Will Blow Fresh Air into the Automobile Tunnel

Trim-looking ventilating shafts will stand like lighthouses above the water. The tube will be ventilated in sections, each shaft taking care of the section to which it belongs. Beneath the shaft is seen a cross-section of the tube itself, showing the roadway and the fresh-air duct beneath it. Above the roadway is the duct through which foul air is expelled. In each section will be fans to circulate the fresh air



In a closed garage Dr Henderson made tests from exhaust gases expelled by a Ford car. The effects of measured amounts on men and horses were observed



Within the box is a man who breathes measured amounts of gas. He puts out his hand to have a sample of his blood taken

ber members of the investigating staff were subjected to tests for periods of one hour. They breathed various quantities of carbon-monoxide — quantities that varied from two to eight and in a few cases ten parts in ten thousand of air. A man could stick his hand through a sleeve in the wall of the chamber without admitting air, so that blood could be drawn from his finger. Blood was thus drawn at the middle and end periods and usually one or two hours later. How much air did a man breathe under varying conditions? We made the necessary measurements. Did his pulse rise or fall? We counted the number of the beats. Was his sight affected? We examined his retina and tested his eyesight. Could he stand with his eyes shut after breathing carbon-monoxide in varying amounts? We made the test. Did he become dizzy after physical exertion? We made him ascend and descend four flights of stairs in eight seconds.

Of all signs and tests, headache is the most definite. No one suffered appreciably from headache after a period of one hour in the chamber charged with four parts of carbon-monoxide in ten thousand of air. When six parts were introduced, a slight effect was usually felt. When the amount of carbon-monoxide was increased to eight parts, decided discomfort was felt for some hours, although the subject could still work efficiently. Ten parts of carbon-monoxide made the most resistant man miserable. He had no desire to work for five or six hours after he had breathed that amount of the gas.

After we had conducted these experiments in the small chamber we made large-scale tests. A brick chamber thirty feet square with an air capacity of twelve thousand cubic feet was built—approximately the capacity of a section of a tunnel holding one car. In this chamber we installed a Ford automobile so that the rear wheels turned large paddles that mixed the air. We ran the car under different conditions so as to vary the amount of exhaust gas.

From ten to twenty men at a time were taken into the chamber. They certainly learned at first hand the effect of carbon-monoxide (or oxygen deficiency)—headache.

The Ventilation Problem Solved

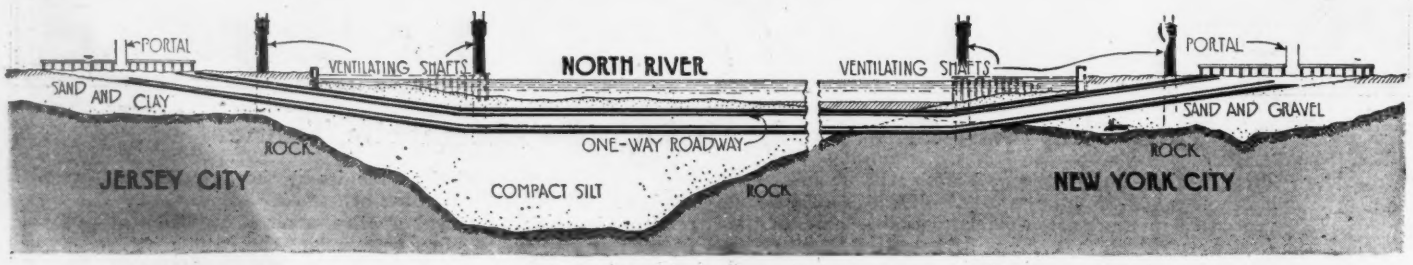
What did we learn from these large-scale experiments? There was slight discomfort due to smoke and smell when the engine was not running well, but the men suffered no appreciable ill effects when concentration of carbon-monoxide as high as five in ten thousand parts was maintained. When we introduced eight parts in ten thousand for an hour, practically all the men became ill with headache and nausea. The volume of breathing proved to be the most important element; it caused individual variations in the effects of inhaling the gas.

We found that the expired air of a healthy man contains five or six per cent less oxygen than the inspired air, and this percentage deficit is nearly the same during rest and during physical exertion with a respiration several times as large. In other words, the volume of air breathed by a man is roughly proportional to the oxidation and energy liberation occurring in his body. A strong, active man, who breathes a large volume of air, absorbs carbon-monoxide more rapidly than a small-breathing man. A motor-truck driver is therefore worse off in a badly ventilated tunnel than a clerk who leads a sedentary life. The difference between the two men in blood-saturation percentages will favor him who breathes least, while persons who walk and thus double their breathing will absorb carbon-monoxide twice as fast as when they are at rest. We can say, then, to the engineers:

"Ventilate the tunnels on the basis that for periods up to one hour, four parts of carbon-monoxide in ten thousand of air will be the maximum pollution for a man at rest."

As a result of the investigation, it is clear that if the tunnels are ventilated longitudinally, or in sections, so that the concentration in some places is only one part or less, the air that finally emerges may contain as much as six parts of carbon-monoxide in ten thousand.

This means a considerable reduction in the cost of ventilation, and yet gives an assurance of safety and comfort.

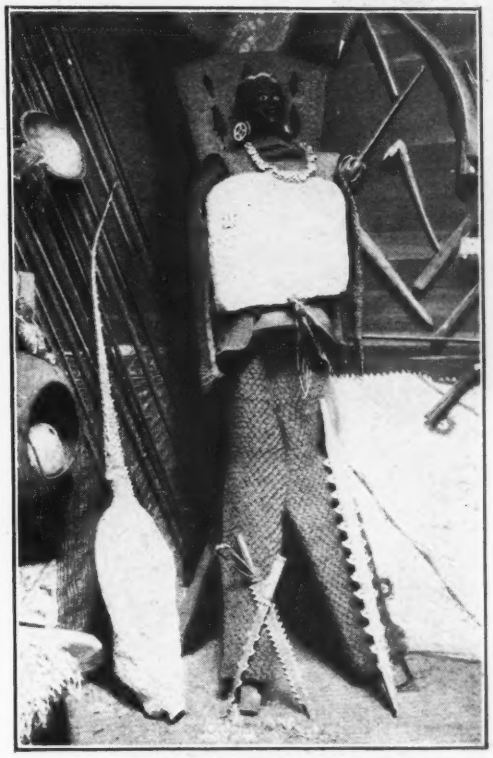


A plan of one of the proposed vehicle tunnels, showing the ventilating shafts. The tunnel, as planned, will consist of metal section tubes, each tube being a "one-way" passage for automobile- or horse-drawn vehicles

Mailed Knights of the Far South Seas

THE Polynesian people inhabiting the eastern groups of the South Pacific Islands, and the Papuans who inhabit the western, were almost continually at war for centuries, and in New Guinea and the Solomons they are still at it. Yet it never seems to have occurred to the majority of these tribesmen to construct any kind of armor. Only on one little group of islands, the Gilberts, where a Polynesian people reside in what is really Papuan territory, was armor invented. Even there it was not in general use owing to the great labor required to make it. Each village of any size was possessed of one of these remarkable suits of armor.

In recent years peace has settled over the Gilberts, and these suits of armor, always limited in number, are now as rare as first editions of Walton's "Compleat Angler." One of the few still in existence is shown in the accompanying photograph. It was made of closely woven coir (string made out of coconut-husk) into a fabric that was as strong as a stout board, but had a lightness no wood could give. This fabric was carried up about two feet above the shoulders at the back to protect the wearer in case an enemy should attack from behind or in the event of his falling face downward, the rear shield would lessen the force of any delivered blow, and save him at least fatal injury. To make the armor doubly strong and proof against spear thrusts a further breastplate made out of the skin of the stingaree or ray fish was attached. This is as hard as bone when dry, but very light.



This suit of armor, which once served the South Sea Islander in combat, is woven from coconut-husk strings

The Gilbert Islanders had an original way of using this armor. As each village had only one suit, it was naturally given to the greatest warrior. When trouble arose with a neighboring village over hunting privileges, the stealing of a woman, or for any of the countless causes for which men fight, the rival villages chose their two best men. Each of these donned his home town's armor and went forth to mortal combat just as the knights in the brave days of old. Thus was the trouble settled.

Beside the armor is shown two sharks' teeth swords, wooden weapons edged with the teeth of the monsters of the deep. These swords are capable of doing terrible damage, inflicting great jagged wounds. Around the neck of the figure in the picture is a string of human teeth, very valuable in the Gilberts. They are greatly prized by the women, and the exceptionally large necklace shown herewith is almost priceless. With this in his possession a man would have all of the Gilbert Island ladies at his feet.

Drawing Unseen Objects by the Sense of Touch

FOR one who can draw it is not so difficult to look at an object and depict it on paper. But to draw by the sense of touch instead of the sense of sight is apparently not so easy; it is a good test of the influence of thought on the senses.

In a demonstration of "mental drawing" the artist was blindfolded, instructed to feel certain objects, and then to draw them. The result was curious. A wooden toy representing a woodpecker was taken for a model of a piece of machinery, and so drawn after a cursory examination. After a more careful examination by the sense of touch alone, the artist made an almost perfect drawing of the real object. He actually drew the toy woodpecker upside down, and did not know, until he saw it, what it was that he had drawn.

The artist ran his hands lightly over a cloth-covered face, feeling the features. Again the mind tried to jump at conclusions. The artist fancied the concealed face to be that of some one known to himself. After his fingers had thoroughly explored the contours of the face, he was able to make a more truthful delineation representing what he had "seen" with his sense of touch.

Any one may make the experiment, either by drawing or by a written description.

A toy woodpecker was placed before the blindfolded artist. He was told to feel it and then draw it. At first he thought it the model of a piece of machinery

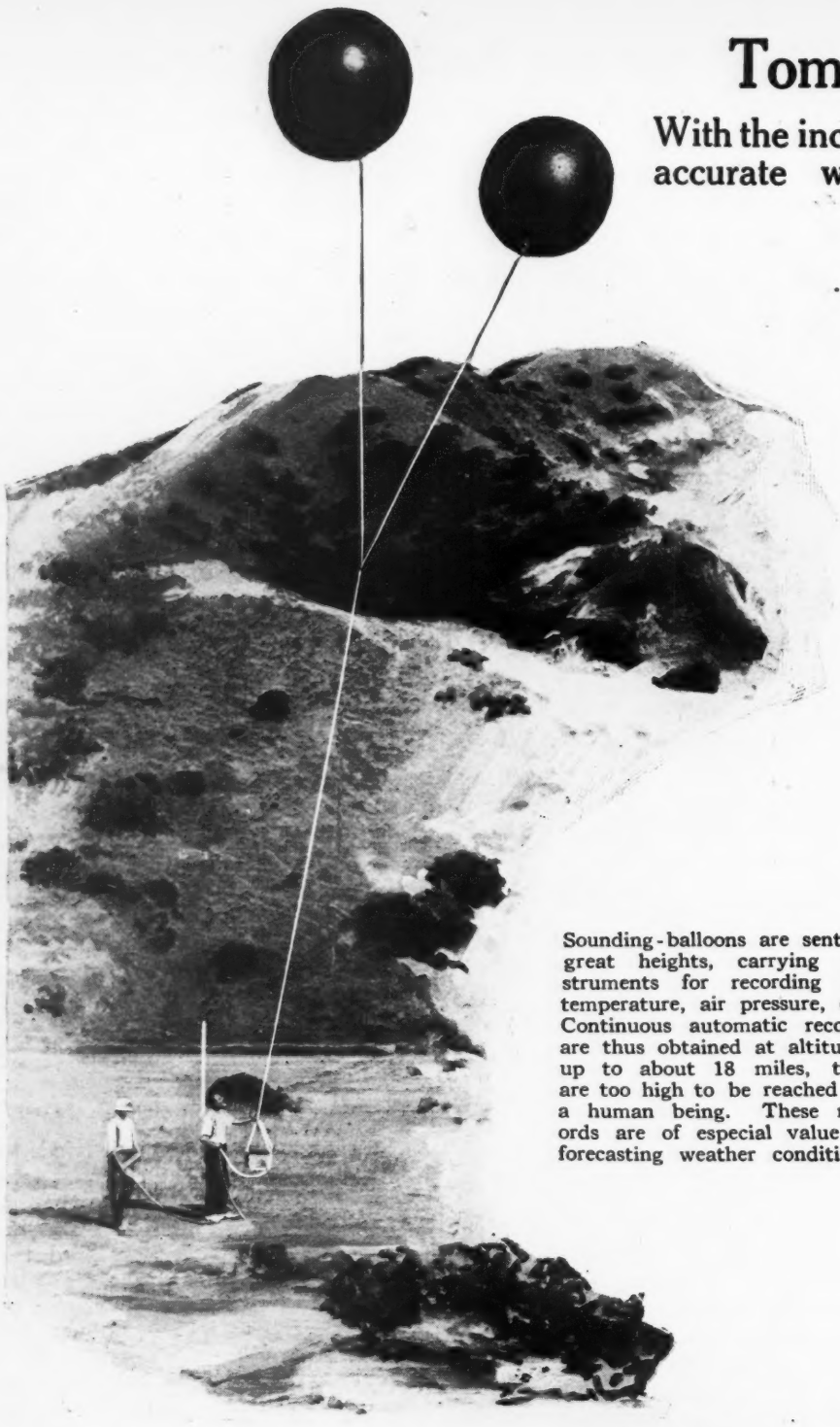
After the artist had studied the shape of the unseen object he drew it upside down. Not until he saw the picture, did he realize what he had drawn

Feeling the covered face of a boy under the cloth is not the easiest way of studying its contours before drawing them. But it is excellent mental training for the artist

Tomorrow's Weather

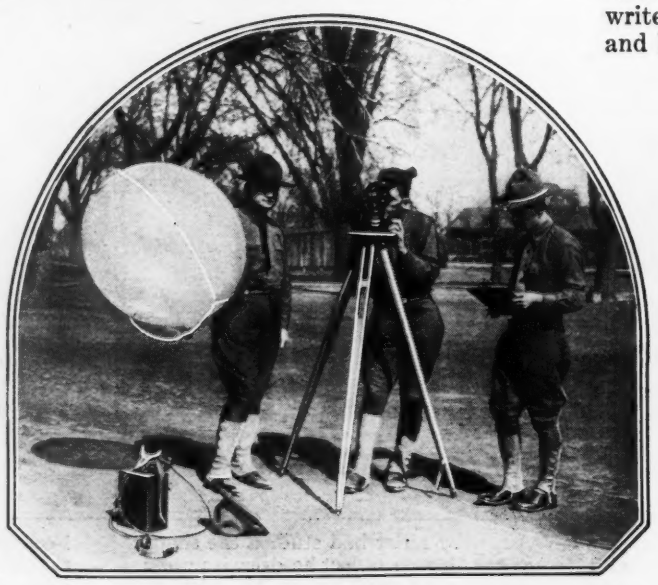
With the increasing use of passenger airplanes accurate weather forecasts are essential

By Calvin Frazer



Sounding-balloons are sent to great heights, carrying instruments for recording the temperature, air pressure, etc. Continuous automatic records are thus obtained at altitudes up to about 18 miles, that are too high to be reached by a human being. These records are of especial value in forecasting weather conditions

Science has added one more task to the weatherman's daily chore—preparing air-charts for airmen. The future will see numbers of weather stations, looking like lighthouses, scattered over the land. From daily charts prepared by the Weather Bureau, airmen will "see" the invisible currents of the atmosphere.



Meteorologists of the United States Army Signal Corps preparing to begin a pilot-balloon run

WHEN the Age of Flight has fully come, the world's weather bureaus will have to expand about ten times their present size, in every way, to take care of the new duties imposed upon them by the demands of aerial navigators.

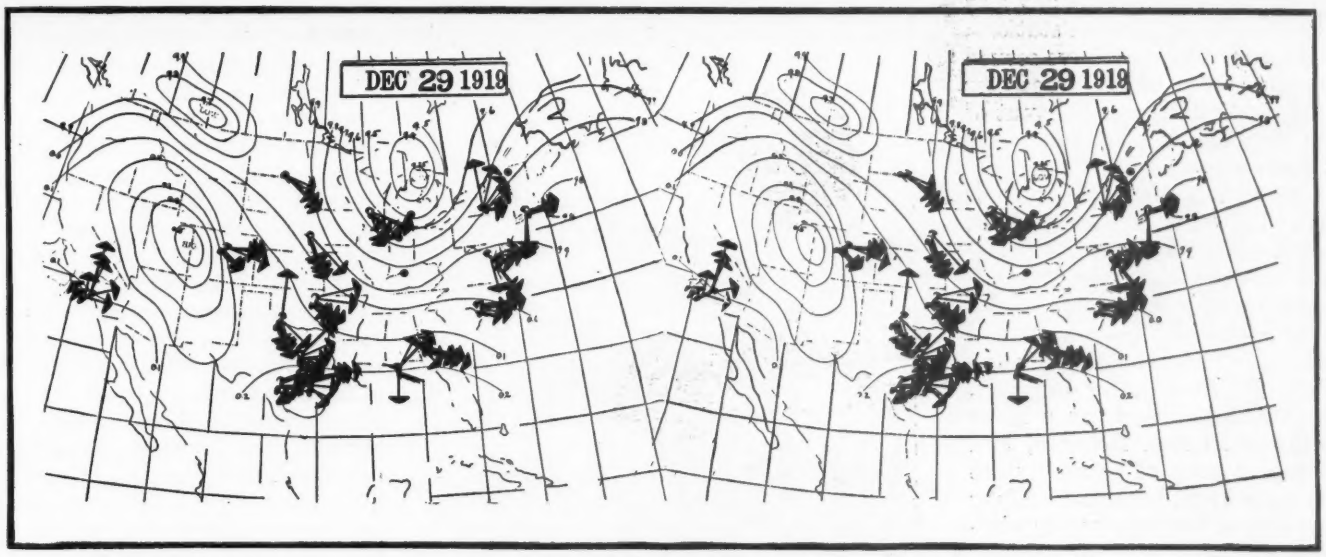
Already these institutions are being expanded as rapidly as possible in response to such demands; but—as is frequently the case—the keepers of governmental purse-strings, both here and abroad, require vigorous prodding to awaken them to needs that ought to speak for themselves, and official meteorologists are finding themselves sadly hampered by lack of the funds for establishing aeronautical weather services.

A sketchy service of this sort exists in the United States, representing the combined activities of the Weather Bureau, the Army, and the Navy. It serves fairly well the immediate needs of the aerial postal routes and the military flying-fields, but it is quite unequal to the demands that are likely to be made upon it in the near future by large-scale commercial aeronautics.

What Airmen Need

It is high time to consider just what kind of service the aeronaut will demand of the weather man, and to take steps to get it. Every reader of magazines knows that meteorologists have already devoted a great deal of energy to exploring the air with kites and balloons. A world-wide atmospheric survey of this character has been in progress for twenty years. The results have made it necessary to rewrite the text-books on meteorology, and have furnished much information of practical interest to the airman. General rules have been deduced concerning the prevailing winds of the globe at different levels, the normal variations of the wind with altitude under given barometric conditions, the typical behavior of thunder-squalls, the average prevalence and depth of fog in different regions, and so on.

Work will undoubtedly continue along these lines; but the object-lessons afforded by the great war show that a practical weather service for aeronauts must perform duties of another character, entailing a far more elaborate and comprehensive organization



The wind in the upper regions is a very important matter which aviators starting upon a trip must consider in advance. To show graphically the currents aloft, a stereoscopic chart is made. Place this picture in a stereoscope and you will notice that the black arrows stand out and show the wind's direction at various levels

than is now possessed by any meteorological institution.

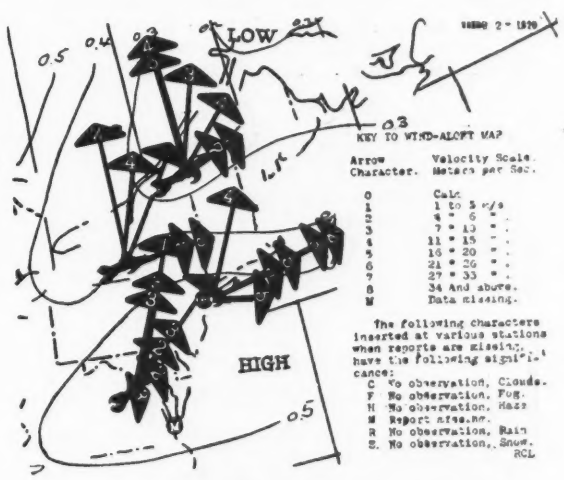
An interesting analogy to these new undertakings is furnished by a recent enterprise of the United States Weather Bureau known as the Highway Weather Service. Reports on the condition of the roads over a given area, particularly with reference to snowfall, are now assembled at a central station within the area, and disseminated for the benefit of automobilists.

Forecasting does not necessarily enter into this work to any great extent. It is primarily a system of reports on existing conditions. The public may be skeptical of the bureau's ability to hit the nail on the head with regard to the state of the highways a day or two hence, but it will entertain no doubts about the value of reports upon their condition at the present moment.

The fact is, the value of all weather forecasts is in inverse ratio to the range of time they cover. This is true of forecasts relating to surface conditions, and it is conspicuously true of those relating to the air aloft.

Value of Weather Forecasts

A slight change in the force and direction of winds in certain regions, or a slight local departure from the conditions broadly depicted on the weather map, may easily retard an aerial journey to such an extent as to eat up all its profits, if it is a commercial undertaking. The success of commercial aeronautics depends in a very great degree upon the utilization of favorable winds. The British dirigible R 34 flew from the British Isles to the United States in 108 hours. The return journey, though covering about the same distance, was made in 75 hours. The difference was due entirely to the meteorological conditions.



Here is an enlarged view of one side of the stereoscopic chart. Each of the arrows is numbered, to indicate the direction of the wind at certain altitudes. A simple calculation enables the making of a companion drawing which furnishes sufficient displacement of the black arrows to make them stand out in strong relief when viewed through the stereoscope

The two hundred regular stations of the Weather Bureau, with a few exceptions, make observations twice a day, at 8 A.M. and 8 P.M., Eastern time, and telegraph the results to Washington, the principal forecasting center, as well as to various other centers.

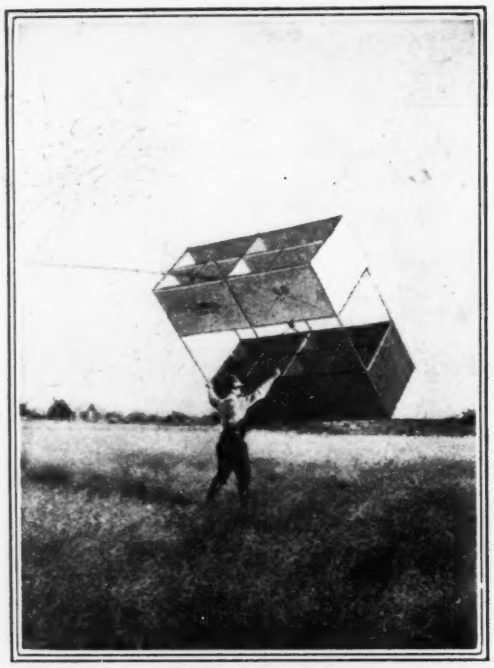
There are twenty-five stations, including those maintained by the Army and the Navy, which make daily or twice-daily observations of the winds at different levels aloft, by means of kites and balloons. In most cases the kite and balloon flights are made in the afternoon, and the reports reach Washington in time to be used in making the evening forecasts.

European meteorologists have anticipated us in the discovery that reports of observations

The weather men were kept busy while the R 34 was moored at Mineola, near New York. Special precautions had to be taken when high winds threatened, or when strong sunshine upset the balance between the lifting power of the expanded gas and the ballast

taken two or three times a day at a relatively small number of stations, however well they may have served the requirements of the forecaster and the public before the advent of aeronautics, are wholly inadequate for flying purposes.

The number of observations at the various European stations has been increased, and the comparatively slow process of assembling the observations and disseminating forecasts by ordinary telegraphy has been largely overcome by radio-telegraphic transmission. In France, for example, reports of observations at a score of places in France, Belgium, and the occupied zone of Germany are now collected and broadcasted four times a day by the high-power wireless station on the Eiffel Tower. Moreover, observations made as often as *seven* times a day at a number of stations in France are disseminated by the smaller radio stations of that country. These reports include a large amount of detailed information not hitherto embraced in weather reports and intended especially for the benefit of aeronauts. This system of frequent and elaborate weather reports, together with forecasts for only a few hours in advance, was evolved for military purposes during the war, but its advantages under peace-time conditions are so obvious that it is being generally adopted in the European countries. The full realization of such plans is, however, greatly hampered by lack of funds.



The Weather Bureau sends kites into the air to determine wind velocities and meteorological conditions. The strings are of wire

As compared with the old-fashioned weather bureau, an aeronautical weather service needs more stations, more men at each station, and special equipment, including kites and balloons and appropriate fields on which to fly them. Last but not least, telegraph tolls, already a large item of expense in the operation of a practical meteorological service, will be greatly increased.

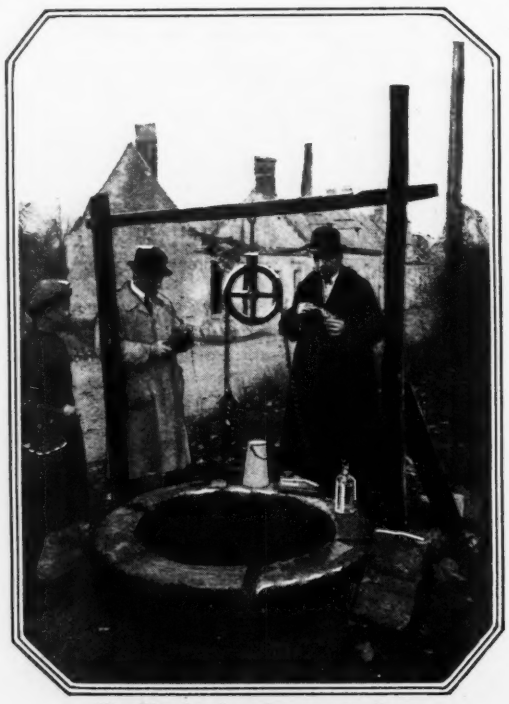
Let us begin now to educate Congress!

Taking the Laboratory to the Well

WHEN the French farmers, after the retreat of the enemy from the fighting zone, returned to their devastated farms in the northern and eastern parts of France, they found their homes in ruins, their woods and orchards cut down by shell-fire, and their fields deeply pitted by shell craters and torn by trenches. The wells, and even the springs, had become contaminated so that the water from them was no longer safe to use. The government, recognizing the possibility of an epidemic, which was almost certain to result from the use of the polluted water for drinking purposes, created a special bureau for testing the wells and springs in the ten departments of northern and eastern France that had been invaded by the enemy.

Now a commission has been appointed for each department, composed of chemists and bacteriologists. A commission travels from place to place and makes preliminary tests of all wells and springs. The investigators, from two to four in number for each traveling unit, make a tour through the district to which they are assigned, in automobiles of a type specially designed for the purpose.

Each car has a strongly made chassis, supporting the boxlike body that gives to the car the appearance of a moving-van. The roof is high enough to permit a man of average height to stand erect in the car. The interior is well lighted by four large windows on each side and smaller transom windows. The driver's seat is protected by a permanent top and front and adjustable waterproof curtains on both sides. The rear wall of the body is horizontally divided in the middle, and the two parts are so hinged that the upper half may be raised and braced to form a roof extension, while the lower half forms a platform resting on iron supports and provided with a small ladder.

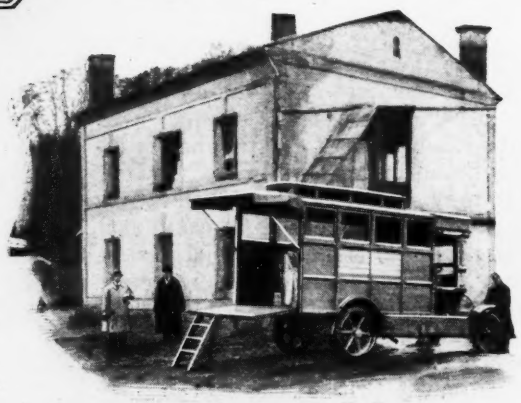


Sterilized tubes draw water from the wells. Contaminated water is sent to a government laboratory for further analysis

The car is equipped with glassware, chemicals, microscope, and other instruments and apparatus for making chemical and bacteriological tests of water. It is roomy enough for comfortably accommodating the investigators during their trips through the country.

The traveling officials, on their arrival at a farm, obtain samples of the water in the wells and springs in sterilized tubes lowered below the surface of the water. Each sample is preserved in a separate, well-sterilized stoppered bottle, and labeled with a number and data fixing the exact location of the well or spring from which it was taken. A complete record is kept of each sample and the results of the tests.

Samples of all waters that are found unsafe by the traveling investigators are then sent to the laboratory of the bureau in the nearest city for a thorough chemical analysis and careful bacteriological investigation.



This is how the French Government sends experts through devastated districts to test the well and spring water

Paris Now Has Scientific Stations for Killing Vermin

ATTENDANTS of the new disinfecting stations in Paris, France, have a convenient scientific method of solving problems of disinfection. Fumes of sulphur are not agreeable to the vermin that find their abode in the clothing of incautious persons; nor are the sulphur fumes pleasant or safe for the individual who wears the clothing. It thus becomes necessary to separate the person from the infected clothing when disposing of the vermin. While the wearer takes a special bath, his clothes are subjected to special treatment.

Besides the sulphur-chambers for killing vermin, there are rooms adapted to other modes of disinfection. Formerly a steam bath was used to kill the bacteria of disease. To prevent the staining of linen it was necessary to wash the cloth before subjecting it to the steam process. This was unpleasant for the attendants and also dangerous.

Five classes of apparatus are now installed in the new disinfecting stations. The first takes care of materials which are unharmed when subjected to superheated steam; the second is intended for those materials which would be affected and spoiled under the steam. These are automatically rinsed before treatment.

One half-hour disinfection through the sterilization produced by heat and moisture kills the germs. The clothing is then dried in free air. In other parts of the stations tanks are installed in which leather shoes, books, and toys can be sterilized by the use of formal gas. The gas is held in weak solution with water and evaporated at a certain temperature. A metal chamber having two doors is used. The materials to be disinfected are carried in one door, exposed to the gas, and then removed through the other door. There are compartments for long exposure at low temperature, and others for short exposure to the gas, at higher temperatures.

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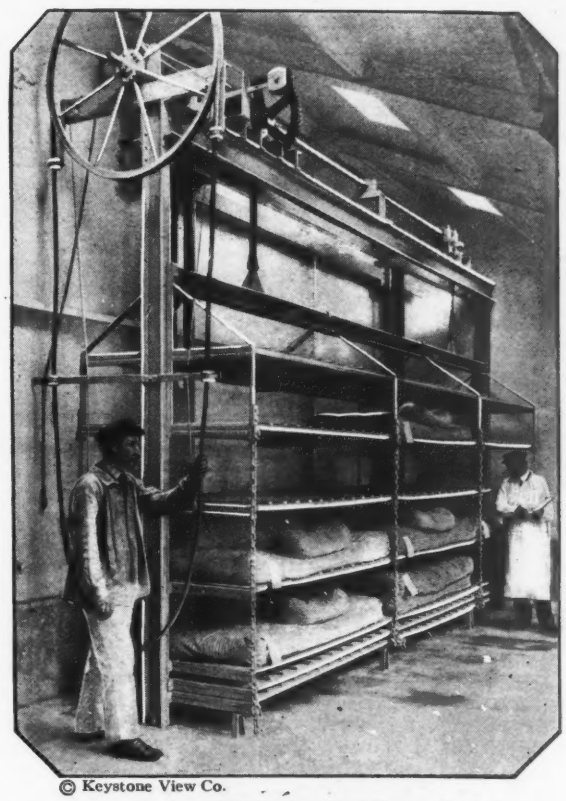
A compartment in which clothing is placed to be subjected to sulphur fumes. The attendants wear helmets and overgarments to protect them from the vermin



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A room for disinfecting bedding. Sealed compartments enclose the sterilizing fumes

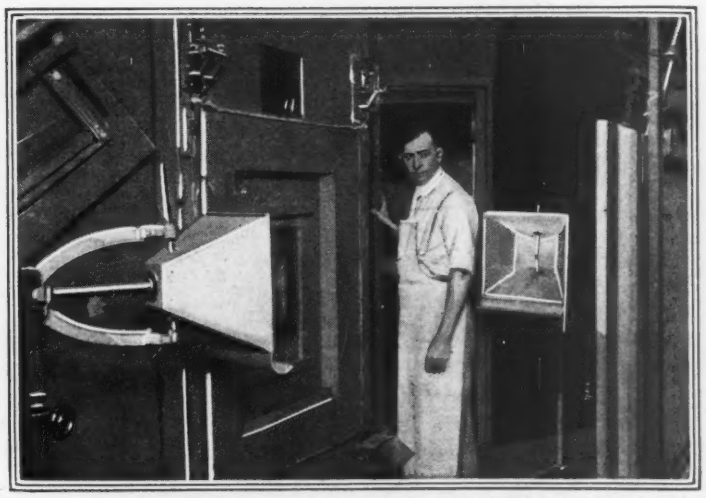
The man who enters the institution for the purpose of being thoroughly disinfected suffers no inconvenience during the process. While his clothing is being sent through the various chambers he is treated to a comfortable hot bath. In about half an hour, or perhaps a little longer, his clothing has passed through the fumes of the metal chambers and every germ is killed. By this time the disinfected clothing is ready.

Step Into the Camera and Take the Picture

SUPPOSE you were small enough to get inside of your camera and focus it from its own point of view instead of from a reflector. It would be a novel sensation, but you imagine the supposition is absurd.

Step into a small room, and make it totally dark, then make a tiny hole in the window-curtain. Look at the wall opposite the hole in the curtain and you will see an inverted picture of the scene that lies in the sunlight outdoors. On the white wall of the dark room is projected the picture as plainly as though it were painted there in faint colors.

The rays of light from the objects outdoors have passed into the room through the small aperture and are brought to a focus on the opposite wall. When a lens is placed in the aperture, the image on the screen will be brighter and, according to the character of the lens, will be better defined.



Two electric lights illuminate the picture to be photographed; the photographer steps through a door into the camera itself

This is the principle of a large camera used for copying photographs. The room itself becomes the interior of the camera.

Back of the lens the photographer adjusts the sensitive photographic plate or sensitive paper. In front of the lens in another room is placed the photograph or object to be photographed. Two powerful electric lights, one at the right and the other at the left of the object, cast sufficient light to make its image of the right intensity to be recorded on the plate in the camera-room.

Hurdling with a Canoe

Some clever tricks an expert has taught his birch-bark steed

Photographs by Universal Film Company

Canoe-hurdling is the original sport of Mr. Charles H. Clark. When he has mounted the hurdle, he balances a moment across the other canoe before taking the downward plunge

When he's ready for the plunge, he tips his body forward and the canoe slides off into the water. He can complete the entire hurdling operation in less than three minutes

Taking a canoe hurdle seems an easy feat for the rider, and one that is pretty to watch. The hurdling canoe rises gracefully at the bow, and slides over the one beneath

A canoe is like a balky horse: its behavior depends on the skill of the rider. Mr. Clark can ride dangerous swells with his paddling partner perched on the bow

Mr. Clark finds that in the wake of a steamer he absorbs some of its speed. He runs down a hill of water at a speed of twelve miles an hour

"They're sinking!" you exclaim. Not at all. These two people are merely showing you that a canoe will stay up and even move toward shore when filled with water

Tailoring a Racer's Sails

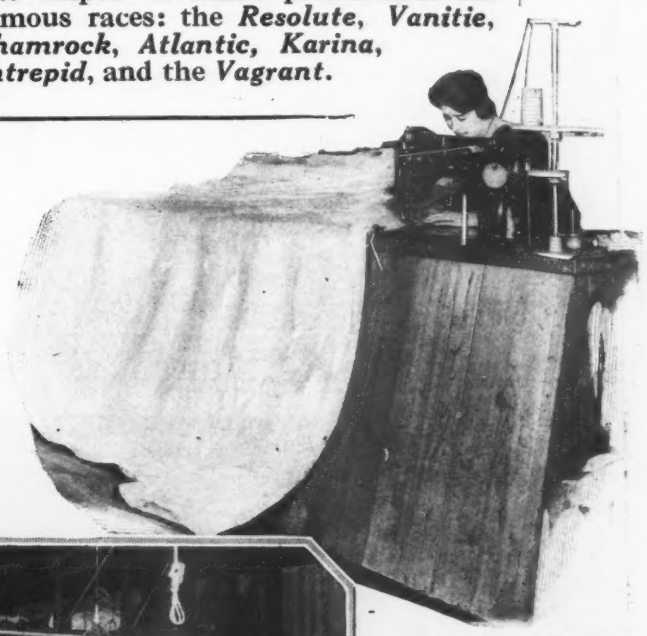
The art of George E. Ratsey, master sailmaker

Making the sails for a racer is an art in which many years of experience brings perfection. To Mr. George E. Ratsey, who comes of a family interested heart and soul in the sport of yachting, the art of sailmaking comes naturally.

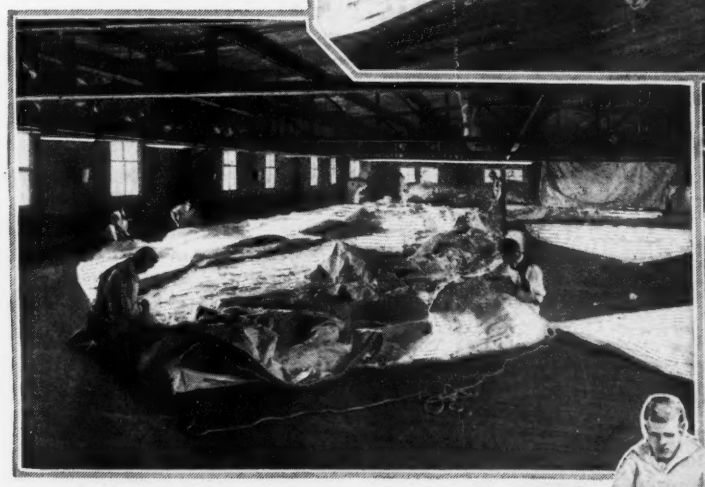
Mr. Ratsey credits his success to the fact that he attends to every detail himself. The business was established in 1790. Here are some of the yachts he has helped to make presentable for famous races: the *Resolute*, *Vanitie*, *Shamrock*, *Atlantic*, *Karina*, *Intrepid*, and the *Vagrant*.

Mr. George E. Ratsey in the office of his sailmaking plant; he is busy over the drawing-board, where some new problems of design are being worked out

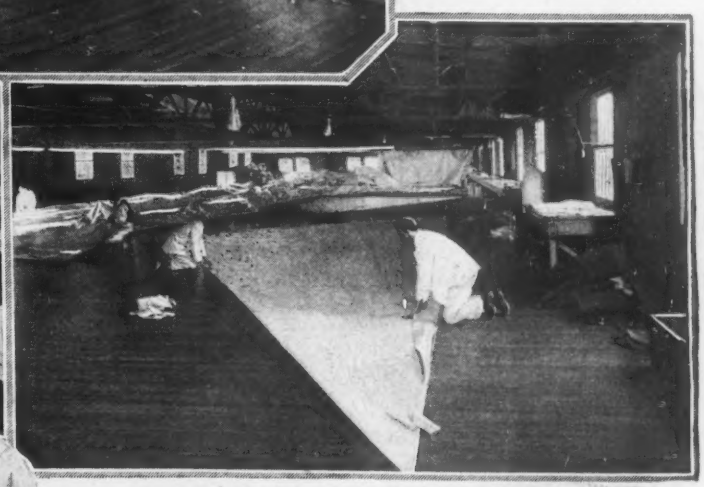
The strips of canvas are trimmed and fitted as carefully as an evening gown. The hemp ropes are stitched by hand, and, in order to run the needle through several thicknesses of canvas, the worker wears a metal disk in his palm instead of a thimble on his finger



Women sew the straight lengths of canvas on machines. Not only must the seams be perfect, but the canvas must be reinforced by intermediate seams, called bights

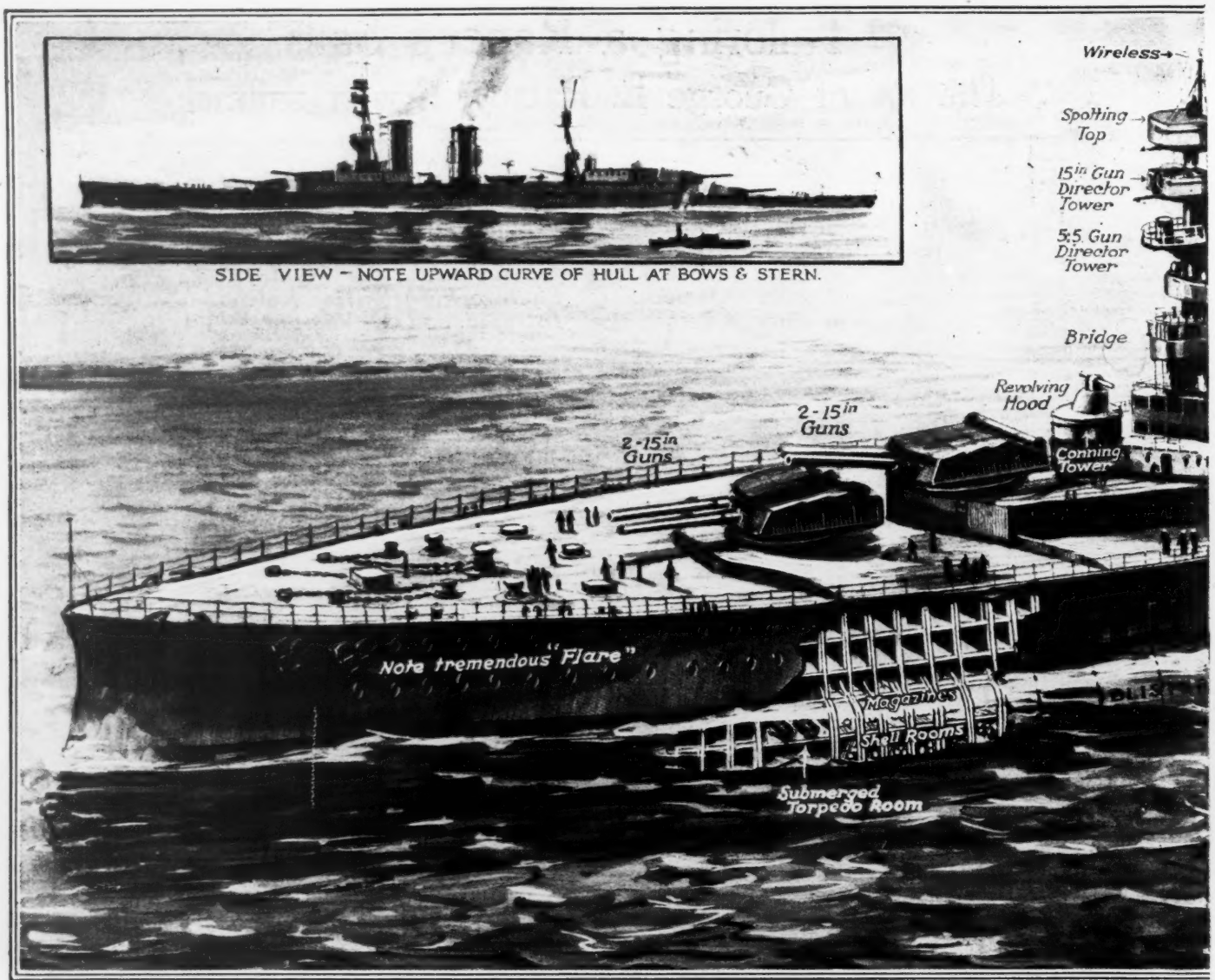


The mainsail of the *Vanitie* is receiving a refitting. This sail weighs more than a ton and measures more than a hundred feet at its greatest length



The club topsail of a yacht. The sails are cut and fitted from designs drawn upon the floor. From these guides as a pattern the sails are finished

Wire "luff-ropes" are attached to the canvas. The sail, when it is first tried out, is carefully guarded against undue stretching by a high wind. On the day of the race the sails of the yacht should present absolutely straight lines



© Sun and New York Herald

England's new super-dreadnought, H. M. S. *Hood*, is the biggest war-ship afloat. torpedo "blisters" on her sides. These blisters, which bulge out mysteriously at

The Railway Fire-Engine

A FIRE in the woods, ten miles from the nearest town—sounds rather bad, doesn't it? And it would have been but for the new fire-fighting railway car. This fire-fighter is a reclaimed oil-tank with a capacity for ten thousand gallons, now used for water instead of oil. It is equipped with two duplex pumps and a tool-box that holds a complete outfit of nozzles, wrenches, tools, and hose.

Steam for running the pumps is furnished by the locomotive, and is fed through a flexible pipe.

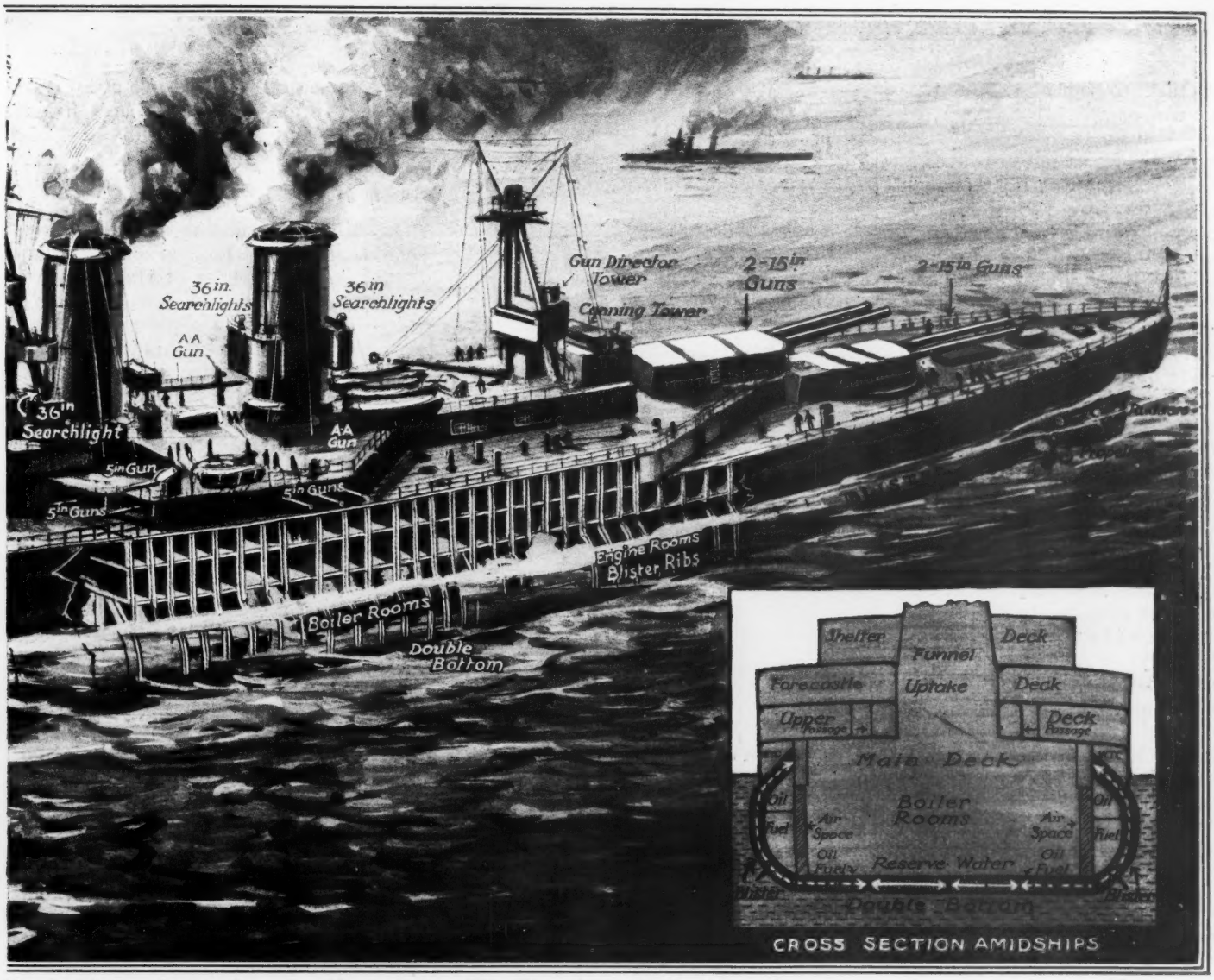
A forest fire near the railroad tracks? This converted oil-tank will race to the scene. It is filled with water now and has two powerful pumps

The Greatest Sea-

ENGLAND'S new super-dreadnought, H. M. S. *Hood*, which cost $30,000,000, is the result of lessons learned in the recent war. She has greater displacement than any of her older sisters, and she is so beamy that locks and many docks will have to be widened to accommodate her. Both of these features are due to increased protection both above and below water. The battle of Jutland proved this necessary, even at some sacrifice in speed.

Below-water protection is provided for by "blistering." The "blister" is a mysterious bulge at the sides and bottom of a ship to protect her from torpedo wounds. Some of England's battleships were thus "blistered" during the war.

In spite of the *Hood's* immense size, a very large part of the hull is covered with heavy armor. On the turret roofs the armor is of double thickness to allow for the effect of plunging fire, which proved so destructive in the first North Sea engagement. Everything has been done to secure the utmost strength and resisting power. In fact, the *Hood* is better equipped to resist attack from any weapon known to naval science than any war-ship afloat. The *Hood* could hardly be sunk by torpedoes, according to Sir Eustace



She is 70 feet longer than the *Mauretania*. The *Hood* is equipped with anti- bottom and sides of ships, were used successfully on ships during the war

Fighter of Them All

Tennyson-d'Eyncourt, Director of Naval Construction at the British Admiralty.

The *Hood* carries eight fifteen-inch guns, mounted in such a manner as to permit them to be elevated through an angle of thirty degrees, thus increasing their range to forty thousand yards. The Germans were the first to resort to the elevation of guns so as to increase their range—this before the war. There are several five-inch guns and a few anti-aircraft guns.

An elaborate system of fire control known as director firing has been installed. It includes the main director station on the tripod foremast and a long-base range-finder in the gunnery control. No official details of the torpedo armament are available, but the present tendency is to revert to the above-water position for torpedo-tubes.

The *Hood* is 860 feet over all.

A Traveling Welder

BROKEN metal is best mended by welding. This, of course, means bringing the broken edges to a white heat, so that, when joined together with fresh fusible metal, they re-unite with a strength equal to, or in many cases greater than, the metal of the tool or article which is to be mended by the traveling welder.

Until recently it has been necessary to take the broken parts to the welder. But now portable electric welders have been perfected.

The illustration shows one of them in action. It is being used to repair a broken dredge bucket of a machine operating on a river.

In the case of railroad locomotives, such a welder is of great value. It can be used directly on the locomotive for repairing the broken section, eliminating the necessity of removing the parts to be repaired and resulting in a saving of time.

Indifferent to rain, the welder repairs a broken dredge. He is using his portable electrical welding machine

See Yourself in Your Dog's Eye

LOOK into the eye of a person or a dumb animal and there will be seen a reflection of yourself and the surrounding locality, if there is light enough to make objects visible. A bright background reflected from the eye makes objects closer to the "mirror" appear in silhouette. It is interesting to thus see oneself in the eyes of others, but it is more interesting to be able to photograph the reflection.

The eye is an optical instrument composed of a lens as the light-collecting part. It is from the strongly curved front of the crystalline lens that the light is reflected. Strong contrasts of light and shade are necessary to make the image perceptible, and as the image is very small, one must look closely into his friend's eye to see the minute reflection.

The eye of a beetle contains many exceedingly small lenses. By the aid of a suitable microscope to magnify the infinitesimal images formed by these little lenses, it has been possible to photograph them. Think of seeing the image of a postage-stamp in its multiple reflections, actually photographed in the many lensed eye of an insignificant beetle! It has been done.

In the eye of the Airedale is seen the reflection of several figures, one of which is the photographer himself. The front of the eye's lens makes a convex mirror which reflects the light, just as a polished steel ball would reflect it. Contrasts are needed to make the image visible

Here, in the kindly eye of a faithful Airedale, can be seen the small image of the photographer, caught in the act of taking his own picture in the dog's eye-mirror. The dark background of the interior of the eye serves as an excellent backing for the lens, making of its surface what is equivalent to a black mirror.

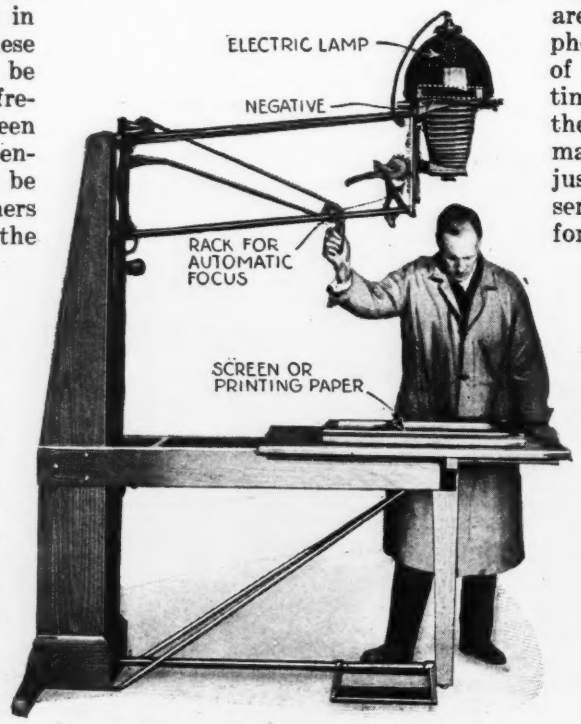
An ordinary double convex lens can be made to illustrate reflection from the back instead of from the front of the lens. Paint the back of such a lens with a coat of opaque black paint and hold a light in front of the lens.

One can readly find the correct position from which he can see the light reflected from the concave back of the lens. If he is at a point too close to the lens, the image will be seen in an upright position, but when he moves to a distance beyond the focal point of the rays of light, the image will be smaller and inverted. But where the reflection takes place from the surface of the dog's eye, the image is upright, like that formed by a mirror, except that it is distorted by the curvature of the eye's surface.

Making Photographic Enlargements Rapidly

ONE of the most interesting diversions of photography is making enlarged prints from one's negatives. Many of the cameras used today are so small that they can be carried in the pocket. Contact prints from these miniature films are too small to be impressive, and enlargements are frequently desired. A device has been patented by which numbers of enlargements of different size can be handled rapidly by photographers who make a business of enlarging the small negatives for their customers.

The device consists of a support that is automatic in adjusting the camera to form a sharp image on the fixed support that holds the sensitive paper. Lenses of different focal length and pictures of sizes within a wide limit can be handled satisfactorily. The size of the enlarged image depends upon the focal length of the lens, the distance of the negative from the lens, and the distance of the lens from the screen. The closer the negative is brought to the lens, the farther the lens must be removed from the screen to make a sharp picture, and consequently the larger the picture will be. When the distance between the negative and the lens is increased, the distance between the lens and the printing paper can be decreased and the image will be less enlarged.



The camera support, which adjusts the lens and negative at the same time that the enlargement apparatus is adjusted

All of this is done automatically when the screws of the mechanism are set. The device enables the busy photographer quickly to vary the size of the enlargement without taking time to adjust the distance between the negative and the lens in order to make a sharp picture. The mere adjustment for the size of enlargement serves also to make the adjustment for definition.

In the old method of working it is necessary to move the enlarging lantern to a suitable position from the screen to provide the correct size of the enlargement desired. Then the distance between the lens and the negative must be altered to bring the image into sharp focus.

Two operations are thus required. The busy photographer now does the whole work in one simple operation. When he has adjusted the image to the size desired, all he has to do is to place the paper in the holder and make the exposure.

When one has a number of prints to make, this saving of time is important.

Surgeon to Worn-Out Documents and Books

In his attic laboratory at the Congressional Library William Berwick restores priceless old manuscripts

By Fred C. Kelly

IT is astonishing how the world contrives to learn about master workmen who toil quietly in obscurity. For example, there is William Berwick, whose workshop is in the attic of the Congressional Library at Washington. He is attached to the manuscript division of the library, and his official title is Restorer of Ancient Documents.

Berwick works entirely without press-agents, brass bands, or publicity funds. Yet, in various parts of the world those who have occasion to know of such things are aware that William Berwick possesses more skill at repairing ancient manuscripts and documents than any other man now living.

A few years ago the Guildhall Library in London wished to have restored a collection of records of the Cutlers' Guild, dating back to the time of the great plague of 1665. After an investigation, they decided that if they were to have the best possible workmanship on this valuable historic record, they must send the tattered pages to William Berwick, Congressional Library, Washington.

The papers were so ragged and decayed that they looked like the lining of a rat's nest. Special arrangements had to be made to get them through the Customs House without examination, for one extra handling might have ruined them beyond repair.

Almost-New Books for Old

When Berwick got through with them, they were as firm and usable as when first prepared back in the seventeenth century. And only a close scrutiny under a microscope will reveal where his repairs were made. So skillfully does he bevel the edges of the paper when inserting a patch or adding a new margin, that the finished product looks like a fresh sheet of saffron-colored paper, that has merely become slightly spotted by having got wet.

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William Berwick, noted restorer of old manuscripts at the Congressional Library, working in his laboratory on time-worn pages written by Thomas Jefferson

While at work on the Guildhall documents, Berwick had an odd experience that might almost be classed as a bit of adventure. In the process of rejuvenating the papers he was steaming certain sheets. He noticed a streak of red that began in a mere spot and then extended nearly half way across the paper. It was not red ink, because ancient ink does not flow in the steaming process. Neither was it blood, for he had not cut his finger. He placed the red spot to his tongue. It was wine! And the startling fact was that it had been spilled when the sheet was still blank, for the writing seemed to be *on top* of the spot. Evidently he was tasting a drop of wine that had been spilled away back yonder more than two hundred and fifty years ago!

Restoring Washington's Will

Berwick was called upon to restore the original will of George Washington, consisting of some thirty-five pages of foolscap—all but twenty-three containing his signature.

Berwick was born in England, but he has been at his present job in the Congressional Library for the past twenty-two years. He was working in the Government Printing Office at Washington when a happy chance led to his being transferred to the Congressional Library.

Proving how a stray bit of knowledge may become useful, Berwick recalls going to a Sunday-school entertainment when he was eleven years old and seeing a man demonstrate how to split a sheet of paper and thus separate the writing on the two sides. The feat interested Berwick at the time, but he never thought of it again until a few years ago when he had to repair a document having writing on both sides, and so thin that it could not stand much handling. Then he remembered the paper-splitting trick—now almost a lost art. He steamed the sheet, took it apart, and added a new middle layer, making the finished product firm and strong. With a covering of thin silk gauze glued invisibly over the writing, that sheet would stand handling for many years.

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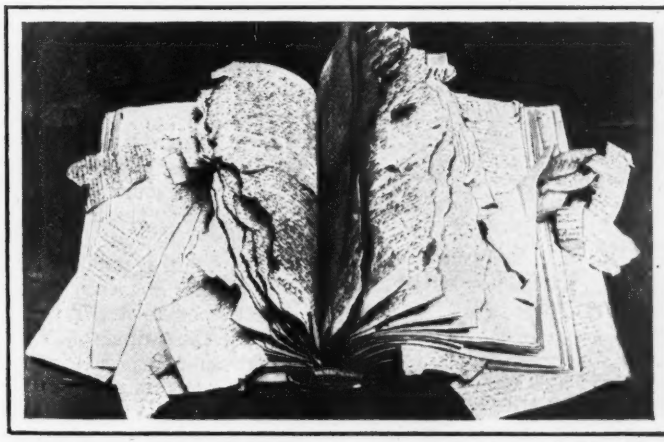

This was the condition of an old volume of records of Virginia when Mr. Berwick received it for restoration

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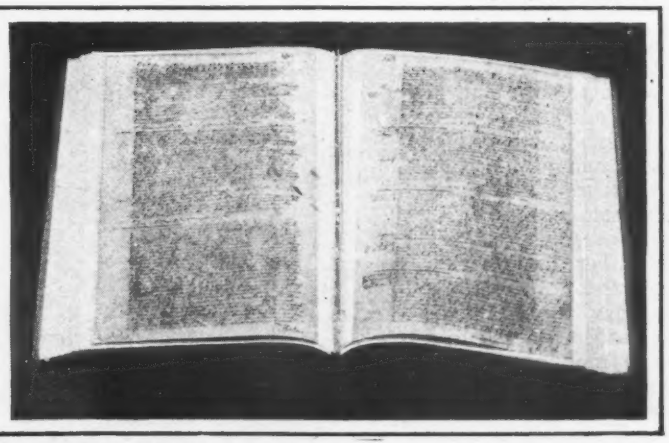
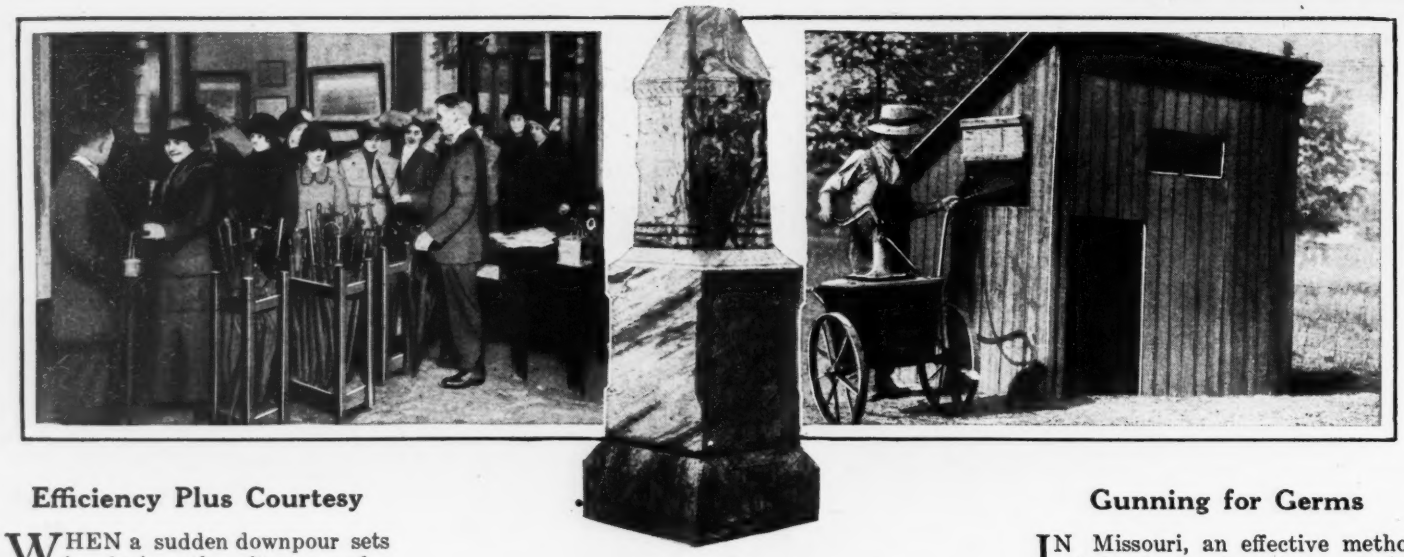


A Maryland land record after Mr. Berwick repaired it. It was in an almost ruined state when sent to him



Efficiency Plus Courtesy

WHEN a sudden downpour sets in during the afternoon of a clear day thousands of men and women find themselves without an umbrella.

In Dayton, Ohio, is a great industry conducted on the plan of utmost business efficiency, and courtesy plays no small part in this plan. Comfort in every possible way is provided for the workers, and their interest in the company is further stimulated by a profit-sharing system. Also when a sudden rain comes up and catches the employees of this plant without umbrellas, the company has a supply which it lends to them.

When the Weather Is a Sculptor

HERE the plain shaft of a tombstone has turned into a perfectly sculptured human face, and those inclined toward psychic beliefs might see in the phenomenon an attempt at materialization from the invisible universe of spirits. But very material forces are responsible for the face carved in this monument.

Erosion, due to alternate freezing and thawing, is the weather-sculptor's right hand. It works perpetually all over the earth.

Upon the upper block of the monument can be seen the face of a man. He wears a heavy, upturned mustache, and a long, well trimmed beard.

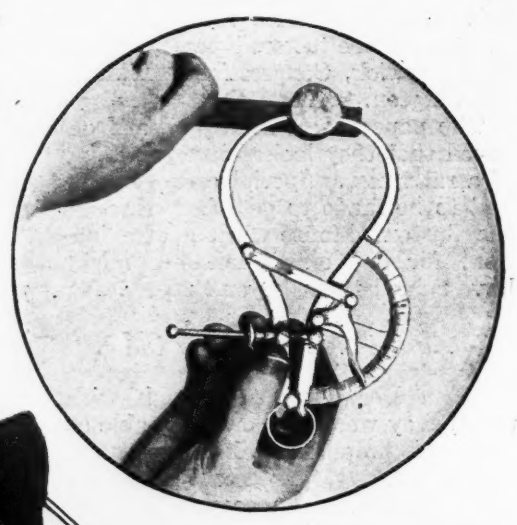
Gunning for Germs

IN Missouri, an effective method of combating hog-cholera germs was discovered. The warfare against the germs was waged vigorously with a hand-power spray as a siege-gun whose ammunition is cresol or other coal-tar disinfectant in proper dilution.

The machine is wheeled around, the liquid atomized by means of a hand-pump operated on top of the disinfectant container, and the sty thoroughly sprayed. The nozzle of the spray is pointed into the compartment where the hog-cholera germs are to be exterminated. It is a very simple device.

The Curious Rocks of Amoy

CHINA'S mountains and rivers glisten in the sunlight when the stars glitter in the heavens of America. The country is rich in agricultural and mineral wealth, and its natural scenic wonderland is associated with the cradle-days of civilization. These remarkable formations, called the "Amoy Rocks," lean against each other in impressive bulk, forming a grotesque outline when seen from the harbor.



Lock the Electric Bulb

ELECTRIC-light bulbs are often necessarily left out in exposed places where any one so inclined can take them. But there is a way to lock the bulb and at the same time to insure it better protection from a shock or jar which otherwise would break either the filament or the glass.

A strong wire frame is fitted into a metal disk which is firmly attached to the metal part of the bulb. The steel wire guards are heavily tin-coated and are electrically welded, forming one unbreakable piece.

© Keystone View Co.

You Can Read the Inches

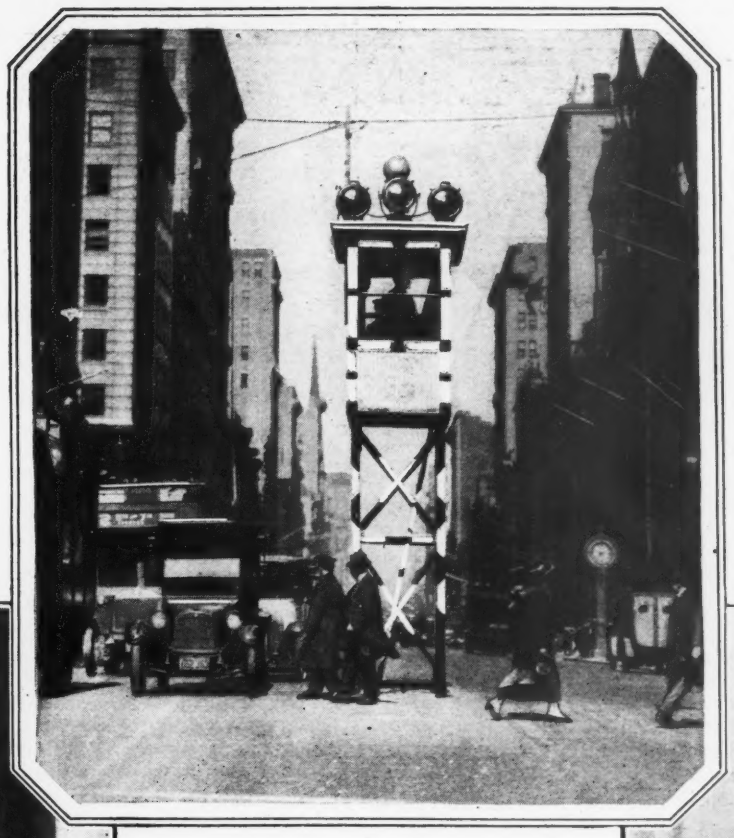
WHEN you tackle anything with calipers in order to measure it, you need the assistance of a ruler.

A calipers is not interested in inches, and simply does your measuring for you. But now there is a new calipers, invented by Robert Eames of Detroit, that has a pointer and a circular scale attached to it. When you open the calipers the pointer moves too, and indicates the exact number of inches on the scale. The scale is attached to one of the arms of the calipers, but leaves the point free to move.

A New Gas Treatment for Horses

DURING the war German horses were badly neglected, and many of them are now suffering from skin diseases. A new hospital has been built for their benefit just outside Berlin, and here they are given a new gas treatment.

The sick horse is led into a small booth and his head is thrust through a sort of cap into the fresh air. The booth is lined with pipes that contain the gas. While being treated, the horse looks out, breathes the fresh air, and is indifferent to what goes on inside this specially constructed booth.

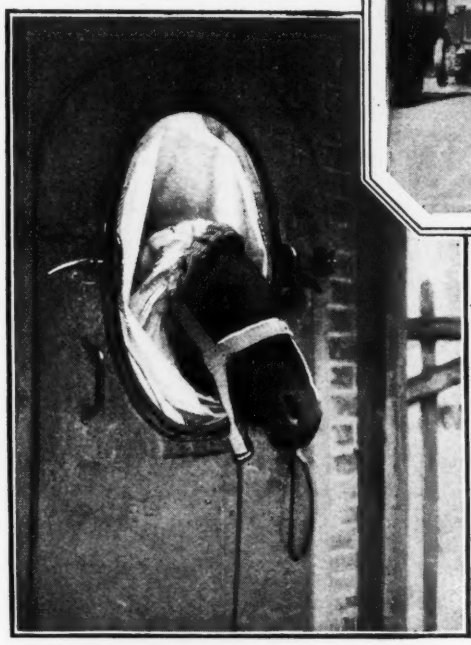


The Homeliest Woman in the World

"MY face is my fortune," said the pretty milkmaid. "And so is mine," says the lady below. But her reasons are different. Her fortunate face won her a five - thousand - dollar prize in an ugliness contest. And now she has come from England to appear in American moving-pictures.

Her name is Mrs. Mary Bevan. Watch for it in the headlines!

You see, you don't have to be beautiful in order to get into the movies. If you are ugly enough, your chances of a movie job are very good.



Lights Control Traffic

THE traffic on Fifth Avenue, New York, is perhaps the heaviest in the country. Even with a policeman at every corner, it is very difficult to regulate. So the city recently installed signal towers like the one above at intervals along the avenue. A policeman in the tower does the regulating by pressing buttons that cause lights to flash in the three great globes above.

At present, the yellow light located in the center signals vehicles to move up or down Fifth Avenue. The red light is flashed on for a few seconds to warn drivers that side-street traffic is about to start. When the green light flashes, all vehicles come to a stop and side-street traffic begins to move.

Walking Home with the Family Dinner

"WHO is that man with the peculiar can?" "That's the family provider bringing the evening meal home to his family." Then the curious ones passed on. But the man didn't. Neither did the can.

After a careful examination, the can turned out not to be a can at all. It was a specially constructed thermos container in which was everything rom soup to hot coffee, each dish in its proper place and most appetizingly prepared by the members of the Evanston Cooperative Cooking scheme of Chicago, Illinois.

The man's family met him at the door, the wife took charge of the thermos container, and inside of fifteen minutes the meal was being consumed.

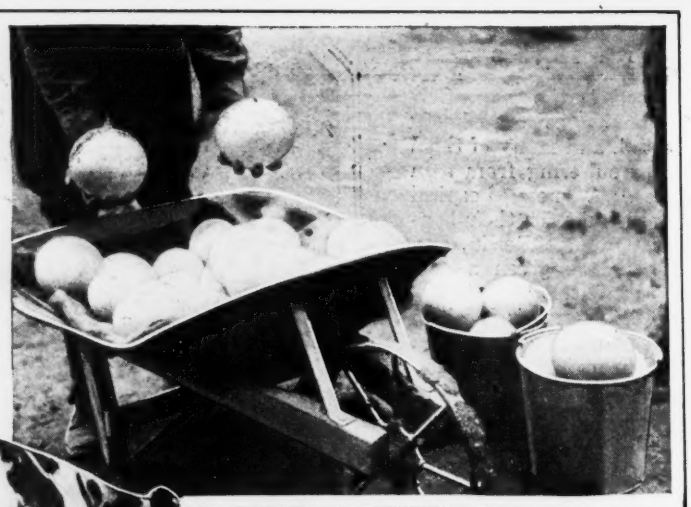
It is always cheaper to buy and cook in large quantities. Thus the cooperative cooking plant is able to prepare meals and sell them at a profit to its customers.

Measuring Energy by Breath Control

DID you ever pant and gasp after climbing several flights of stairs? If you have, you are an excellent subject for Mr. A. D. Waller's experiments, conducted in London, England.

Stand at the bottom of the stairs. The experimenter places in your mouth a tube attached to a bag. You breathe into this, and it is removed. Then you begin to climb, breathing quietly. At the top of the second flight you are panting. A second tube, attached to a bag similar to the first one, is placed in your mouth, and you sobbingly breathe into it.

Mr. Waller takes the two bags into his laboratory and figures out how much carbon-dioxide was breathed into the first bag and how much into the second. The difference in the amount of carbon-dioxide contained in each bag will determine the amount of energy which you expended in climbing those two flights of stairs.



No Quarantine for This Baby's Voice

SO near and yet so far! Wives and children of the men on board H. M. S. *Renown* know well what this means. The battleship was quarantined after returning from a long voyage. Eager relatives thronged the dock but were unable to talk to their menfolks on board. And then some one thought of a speaking-tube. It was rigged up from shore to ship, and all the relatives took turns at the tube.

Put the Milk-Pail in a Holder

THIS device was patented by Jean H. Ormandy, of Healdsburg, California. It consists of a metal frame in which to hold the pail. A strap can be attached to it so the pail can be held conveniently to the person, or the strap can be swung around the neck. In the lower part of the frame is an arrangement for holding a pointed stake, so that the pail can be staked to the ground.

There should be no complaint from any one but Bossie herself when she finds that, try as she will, it is impossible to kick over the pail.

Where Your Ostrich Feathers Come From

FASHION calls for ostrich feathers and all the ostrich farms get busy. There is a large one at Pasadena, California, where many a feather gets its start in life.

Ostrich eggs are quite large and usually weigh about five pounds. They are carefully collected in pails and wheelbarrows and hatched into baby ostriches. The feathers in their natural state are grayish-brown.

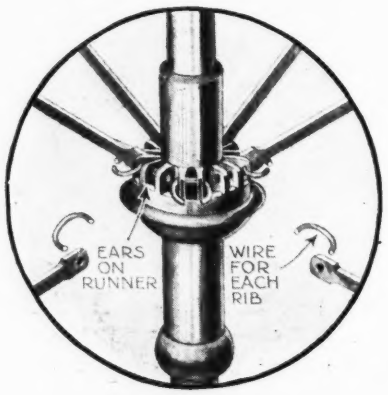
Assistance to Johnny-Jump-Up

THE inventor of this spring does not seem to realize that it takes energy to compress a spring, and that the recoil is due entirely to the efforts of the man who wears the spring. The walker who uses this invention may meet with many a surprise, not all of which will be pleasant, if the base of the springs comes in contact with the pavement at a disastrous angle.

The Cow's Friend

COWS regard with favor the new one-horse well. This well has a long ungainly bucket made of cowhide that adequately supplies them with plenty of drinking water.

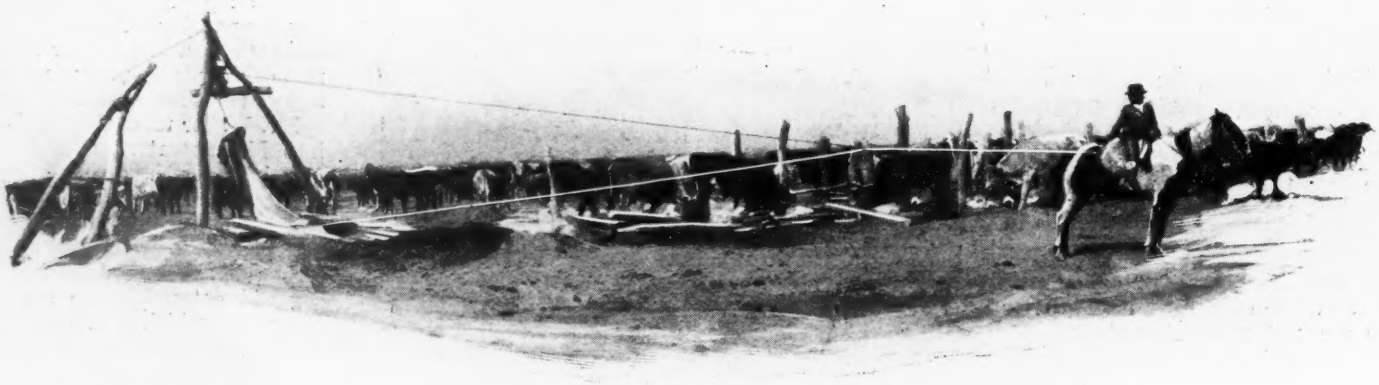
The horseman ties the rope which runs over the pulley from the cowhide bucket to the horn of his saddle. He lowers the bucket and drives his horse forward. The bucket comes to the surface. The horse is halted, the horseman dismounts and pours the water into a trough. The impatient cows slake their thirst and walk away, with no regrets at the passing of the old oaken bucket.



An Easy Way to Mend Umbrellas

GIVEN a strong wind and rusty wires, the ribs of your umbrella are almost certain to puncture their cover.

A recent invention prevents this and facilitates the repairing of the ribs. Charles W. Martin, of Brooklyn, New York, has devised a separate connection for the metal "stretchers" so that when one of them becomes disjointed it can be mended without removing them all.



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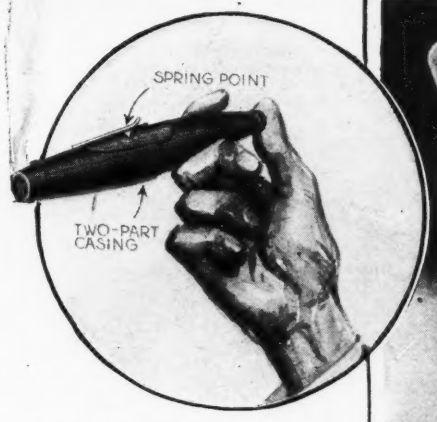
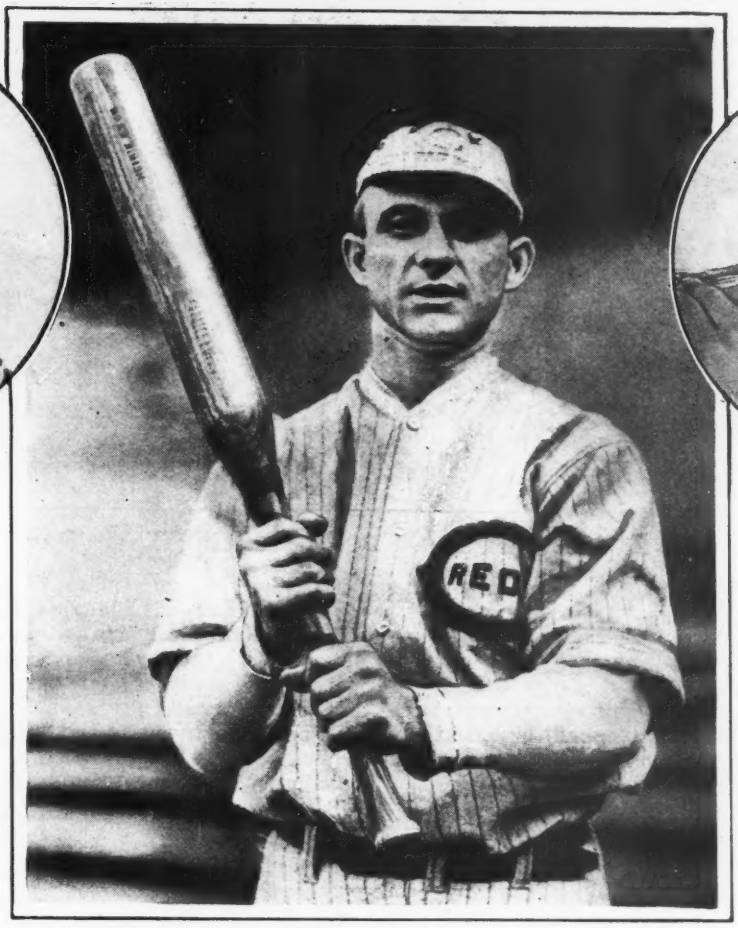


Catching the Ashes

MUCH has been said about ashes and dust, mostly in connection with housekeepers' troubles.

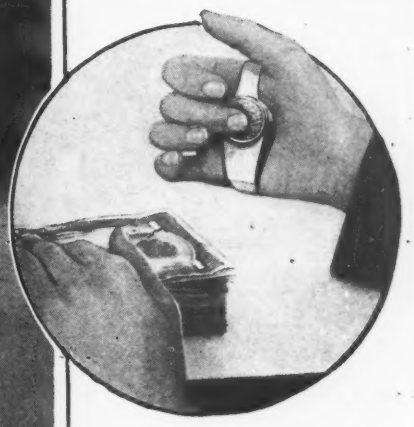
A new cigar-holder has recently been invented that will hold your ashes until your cigar has reached its end. The holder is a curved metal tube that completely envelops the cigar. It is made so that it may be extended to fit any cigar and is pulled apart to let the cigar in. There is a regular mouthpiece at one end of the holder and at the other end there is an opening through which air is admitted.



Will This Bat Help to Win the Pennant?

HEINIE GROH was worried about his batting average and he decided that his bat was at fault. Whereupon he appeared on the diamond with the new one shown above. Quoth Heinie: "All bats now in use—except this one—are wrongly built, badly balanced, and do not deliver the 'punch' to the ball." All the weight in the new bat is in the right place to swat the ball a crushing blow. The Giants thought it worth $150,000—with Heinie behind it!

Heinie is a "Red" and he's not ashamed to admit it. In fact, he wears a large Red emblem on his business suit. Other Reds like his new bat and walk off with it when the opportunity offers, in true Red fashion.



The Padded Palm

BANKS employ men who do nothing but count money all day, and they must constantly moisten their fingers. Edward Ode, of Orland, California, has invented a finger-moistener for these counters, and also for page-turners. It fits on the palm of the hand and is held in place by metal clips that extend around to the back of the hand. The moistener is a damp felt pad. It is kept wet by water that leaks through a hole in the wall of a reservoir nestling against the palm.

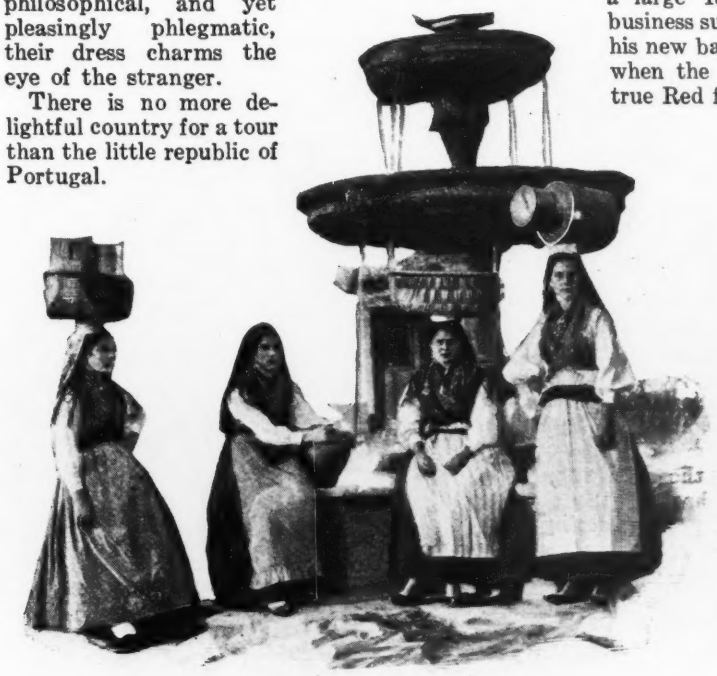
By scratching the palm the fingers are kept moist.

Gay Dresses of Portuguese Peasant Women

IT may be said that the peasants of Portugal are always in gala attire. In the field, at home, or dressed for market-day, the habit of the village folk is but to be admired.

To the eye of the American the array of colors in fabric and design is not in full accord with the conventions of color harmony ; but worn by the bronzed and picturesque peasant of Portugal, winsome, philosophical, and yet pleasingly phlegmatic, their dress charms the eye of the stranger.

There is no more delightful country for a tour than the little republic of Portugal.



Berlin Now Has Some Four-Legged Boarders

IN Berlin some of the inhabitants have the raw material for their meals housed in their homes. They are making the most of flats by sheltering live stock.

Chickens occupy the kitchen. Each hen is supposed to pay one egg a day for her board. Rabbits shyly run about the hallways. They are supposed to give up a victim now and then for the landlord's stew. Goats are in the spare bedroom and are expected to pay their rent with milk.

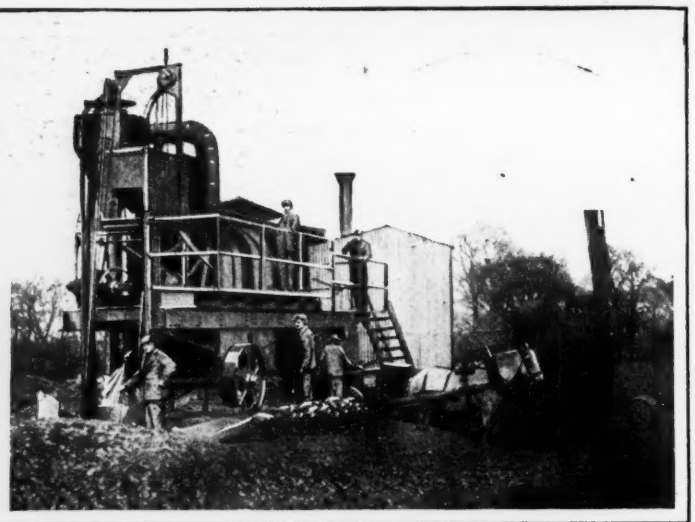
A frau and fräulein are here shown exercising their four-footed boarders.

No Horse's Hoof Treads This Exclusive Street

SOME of the exclusive people in Los Angeles are so very exclusive that they cannot bear the sight of a horse; in fact, they have forbidden horses to walk on their streets. So the exclusive set has rebuilt a road in such a way that horses cannot walk on it.

Two thin strips of concrete were laid a short distance apart on the roadbed, and the space between them was built high, so that a horse could not walk on it without soon falling off.

Automobiles are graciously invited to ride down the concrete strips. What would the people do if a great ugly truck took advantage of the invitation, profaning this ultra modern exclusiveness?



Making Their Own Roads as They Go

JOIN the road gang and see the country! In England there is a huge traveling machine that transforms a dilapidated road into a thing of beauty. The gang that travels with the machine breaks up one half of the road and feeds this material to the steam monster. While it proceeds to mix, crush, and, with the aid of tar and other materials, prepare a new road-surface from the old, the gang breaks up the other half of the road. Half of the new surface is laid and then the other half. No time is wasted. Slowly the traveling machine moves on, leaving a beautiful road in its wake.

This is recommended as an economical way of seeing a country where roads are being reconstructed.

A Sock-Puller for the Aid of Invalids

AN invalid need no longer moan over the stupid way in which his socks sag when he attempts to put them on. Andrew Deiley, of Pittsburgh, Pennsylvania, has invented a device to straighten out sagging socks.

Over the bottom of this device the invalid places his sock, and, before it can slip off, clamps it down with the holders on either side. By pulling the handpieces together, the sock is stretched and with easy precision the foot is slipped into it.

Florida Has Developed a New Delicacy—the Dasheen

A NEW table delicacy is grown in Florida. It is the dasheen, a vegetable which has all the good qualities of the potato. Both the tubers, of which there are a number, and the "corms," like cabbage heads in formation, are edible.

Growers in Florida are turning over many acres of land to the cultivation of this vegetable, which has all the good qualities of the potato, to say nothing of some excellent properties of its own.

Those who have eaten dasheens long enough to acquire the taste for them keep them as one of their staple articles of food.

Perfect Your Putting Playing Golf in the House

THE game of golf is usually associated with the broad green levels and slopes of the golf-links. But there are enthusiasts of the game who do not ignore the possibilities of practising indoors for delicate precision.

The Lady Golfer's Club conducted a "putting" contest upon the carpet of the club room.

Instead of nicely tapping the ball with exactly enough force to send it into a hole in the turf, the indoor player must send the ball up an incline before it can reach the hole placed on the carpet. The task is obviously not an easy one. Notice the picture below.

© Kadel & Herbert

A Vacuum Cleaner for the Player Piano

A VACUUM suction pump for cleaning tracker-bar in player pianos, has been invented by a man in St. Louis, Missouri. The chief merits of this new player-piano device are the patented double-valve suction arrangement, sanitary dust cup and dust screen, designed along scientific lines according to the vacuum-cleaning system. By the operation of this tracker-bar cleaner the debris is drawn through the openings of the tracker-bar and collected in a dust cup.

Press a Button to Keep Yourself Cool

IF you find it too much work to wave a graceful fan in hot weather, buy this more modern type.

You press a button and the tiny blades whirl around just as in the case of a large electric fan. But that is natural since the small one is run by electricity too.

The blades revolve at high speed and create quite a breeze. When not in use, you can fold the fan together and slip the whole thing in your purse.

Would You Like Leg of Lion for Your Dinner?

YES, they're eating lions in Paris now. Lion meat sells for seventeen cents a pound, whereas beef and lamb cost three times as much.

This is remarkable since lions are so much harder to capture than cows.

Above you see the inside of a Parisian butcher shop. A huge lioness hangs on the wall. The butcher will sell any part of her for seventeen cents a pound.

Cutting Logs at 130 Miles an Hour

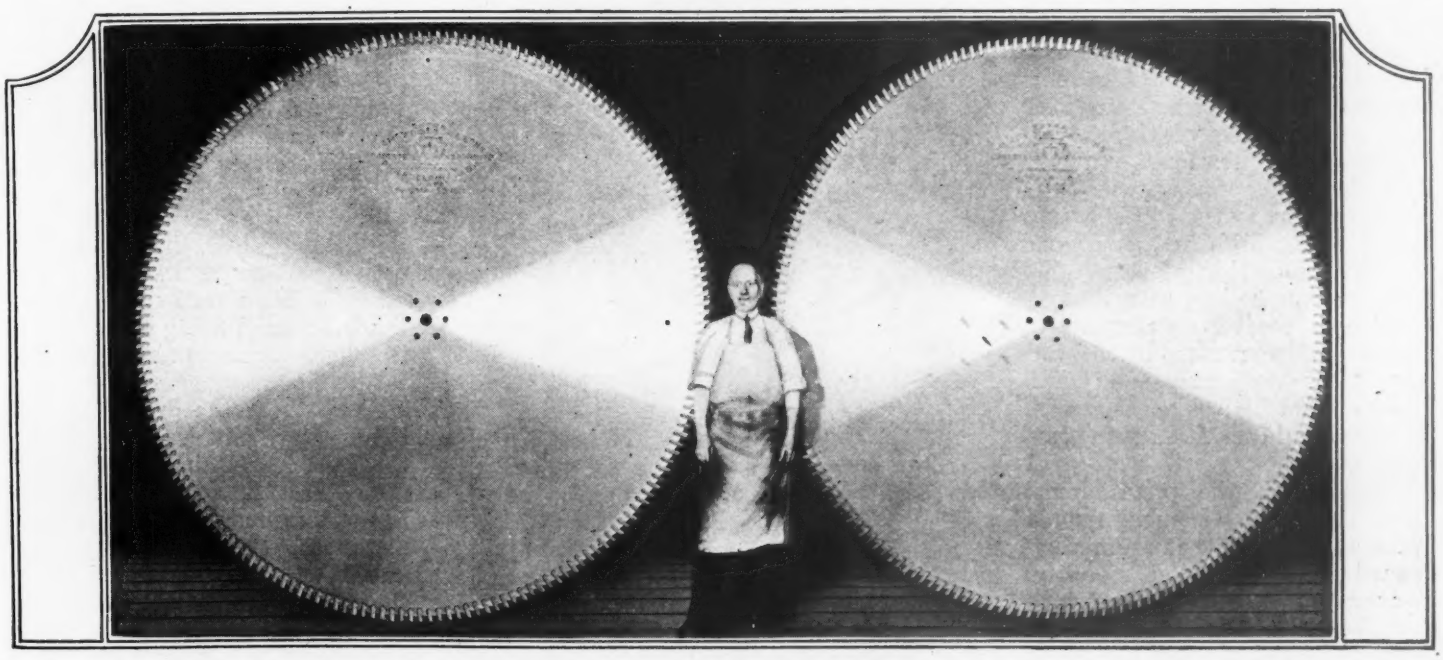
FROM a block of steel which weighed more than half a ton came the monster circular saw. It is nine feet in diameter and has 190 teeth in the rim, and when running at full speed each tooth travels around the circle of the saw at the enormous speed of 130 miles an hour.

The huge saw is at first started slowly. Gradually it gains high speed. Cutting through the air the pitch rises until finally it hums a tune in a high key, and at last the teeth of the saw are cutting at the rate of 130 miles an hour. Logs placed under their keen edge are quickly sawed through.

The Dripping Spout Conquered at Last

A GERMAN will gladly sacrifice the beauty of his teapot in order to spare his ugly red-and-yellow table-cloth from possible tea-stains. Here you see a German teapot. You will promptly note the unbecoming double chin from which the spout suffers. This will catch any drops that try to slide down the spout.

Thus the table-cloth is spared, but at what a cost! The spout loses its natural shape and the hausfrau must find it most difficult to clean. However, you may prefer the double-chinned teapot to a spotted table-cloth.



A Fire-Engine to Raise Sunken Treasure

How modern methods are bringing out of the depths of the sea treasure sunk for three hundred years near the Isle of Mull, off Scotland

By P. J. Risdon

IT has been stated—and it is probably true—that more money has been expended in efforts to reclaim sunken treasure than the total value of the wealth sought for. Many fruitless endeavors have been made and described from time to time, but special interest, from both a historical and practical point of view, attaches to the operations now in progress in Tobermory bay, Isle of Mull, Scotland.

After the dispersal of the Spanish Armada in the English Channel in the year 1588, one of the surviving galleons put into Tobermory bay for revictualing and repairs. According to the state papers of Scotland, there were good reasons for believing that the bulk of the Armada's wealth had been transferred to this ship, and that this wealth, equivalent to more than one and a half million dollars, included the crown for the coronation of Philip II. of Spain as king of England, in the event of a British defeat. As the result of a gunpowder explosion on board, the galleon caught fire, and sank in about ten fathoms of water about eighty yards from the shore.

After countless unsuccessful attempts to salve her, the "Armada Galleon Syndicate" was formed, with Lieutenant-Colonel Mackenzie Foss, a man of great experience in deep-sea diving (more especially in connection with the pearl-fisheries of Ceylon), as director of operations. Colonel Foss finally adopted a new method of clearing away the soft clay into which the galleon had sunk to a depth of some thirty feet, and before the war he had actually succeeded in recovering portions of the cargo. Interrupted by the war, operations were suspended until the spring of 1919, when they were resumed and carried on with great success.

Then, with the prize almost within his grasp, Colonel Foss met with an accident that again postponed operations. A powerful water-jet, which was a principal feature of his salvage plant, struck him and knocked him down, resulting in a very serious injury.

The plant employed by Colonel Foss in the first instance consisted of a salvage lighter moored over the site of the wreck, from which an ordinary boring plant was worked by means of a pile-driver. This boring plant, however, proved unsuccessful, owing to the difficulty of maintaining the lighter steady during swells, and to the fact that the boring rods and tubes were frequently bent in consequence. Subsequently a "grab," worked by a winch from the staging, was used by which the clay was excavated from the seabed and lifted into a screen, where it was sluiced for the purpose of securing "finds."

By this means many interesting objects have been salved, including coins, silver cups, and dishes valued at $500 an ounce, and even bottles of port wine that had been lying in the wreck for more than three hundred years. Among the more gruesome relics were clothing, buttons, and human bones. Unfortunately much damage was done to the recovered articles by the grab; bottles of wine were broken, and silverware was crushed. For this reason the use of the grab was discontinued, and Colonel Foss then had recourse to a different method.

Miss Margaret Naylor, secretary to Lieutenant-Colonel Mackenzie Foss, descending under water to the old galleon

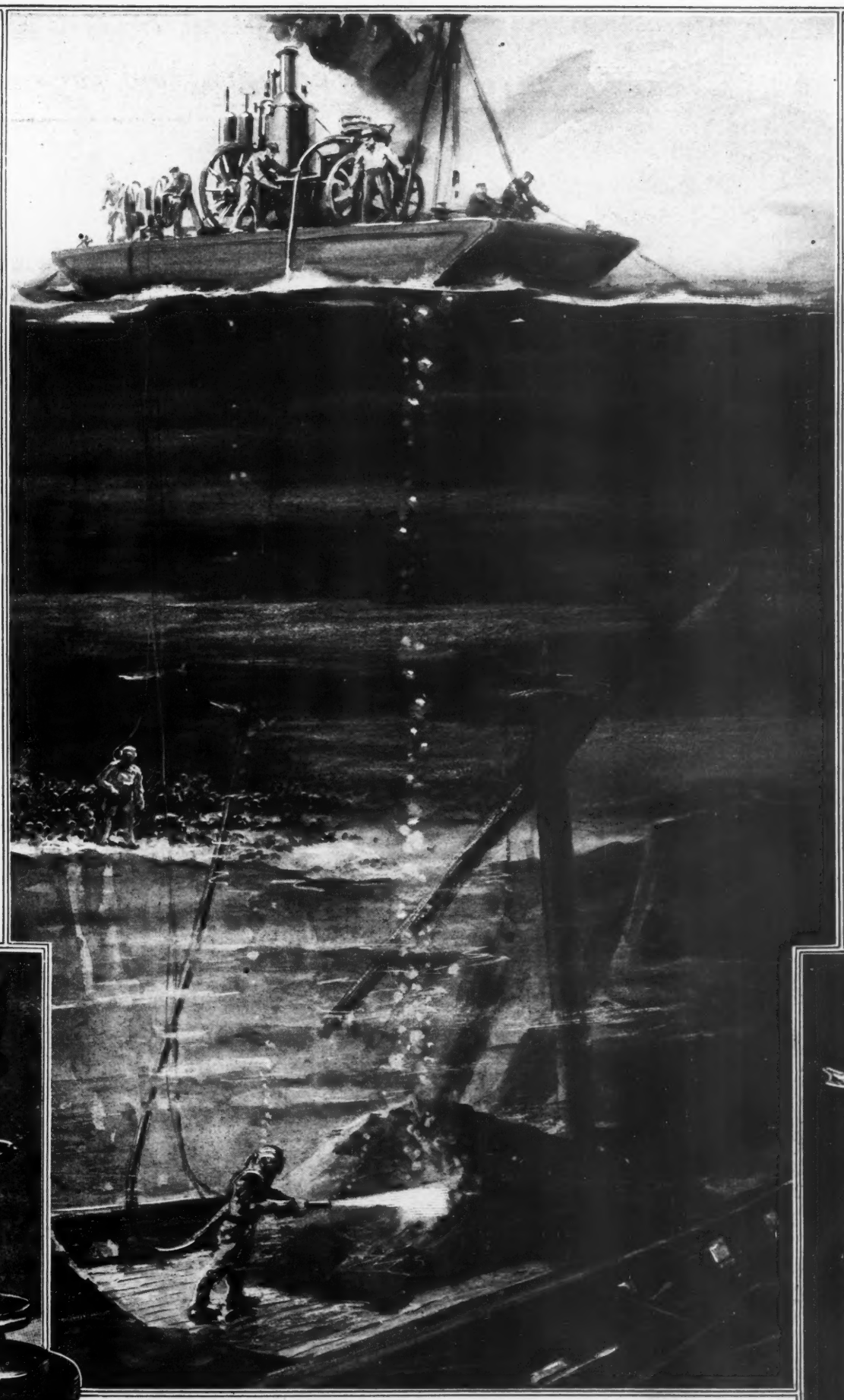
A fire-engine was employed by means of which a water-jet, delivering sixty pounds of water a second at a pressure of one hundred and twenty-five pounds to the square inch, was provided. Deducting a water-pressure of, say, forty pounds a square inch at the depth of the galleon, this provided a jet with a working pressure of eighty-five pounds a square inch, by means of which divers were enabled to remove the clay from the ship. The divers descended by a ladder, carrying the water-jet nozzles with them, and at a given signal water-pressure was turned on. Telephonic communication was maintained between the divers and those in charge above water.

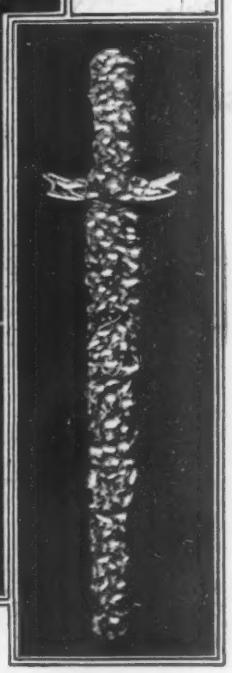
The silver articles and some pure-gold buttons, apparently from the dress of some notable person, were recovered from what is believed to be the stern of the ship, while pewter plates and bronze coins (*reals* of about five cents value each) were recovered from the crew's quarters.

The oak hull of the galleon is in a good state of preservation having been protected from the ravages of the teredo by the clay in which it has been embedded for more than three centuries.

An interesting fact in connection with the salvage operations is that Miss Margaret Naylor, secretary to Colonel Foss, has taken an active part in the work, having descended in diver's equipment to the wreck, and going on record as the first woman to attempt deep-sea diving.

Apart from the great value of the treasure which it is believed the galleon contains, its recovery after three hundred and thirty-two years would constitute an historical event and a feat of great perseverance. It is to be hoped that Colonel Foss will eventually be able to carry the operations to a successful conclusion.





Science Brings Up Precious Objects from the Deep

AFTER lying at the bottom of the Tobermory bay, in Scotland, for three hundred years, a galleon of the Spanish Armada has recently been partly salvaged by operations conducted under Lieutenant-Colonel Mackenzie Foss.

Colonel Foss installed a fire-engine by means of which a water-jet, delivering sixty pounds of water a second, is employed to remove clay from the sea-bed. Divers descend a ladder, carrying the water-jet nozzles, and at a signal water-pressure is turned on.

Many interesting objects have been recovered, among them silver cups and dishes, valuable coins, and even bottles of wine. It is supposed that among the treasures was the crown intended for crowning Philip of Spain king of England, so sure were the Spanish of a victory over the English

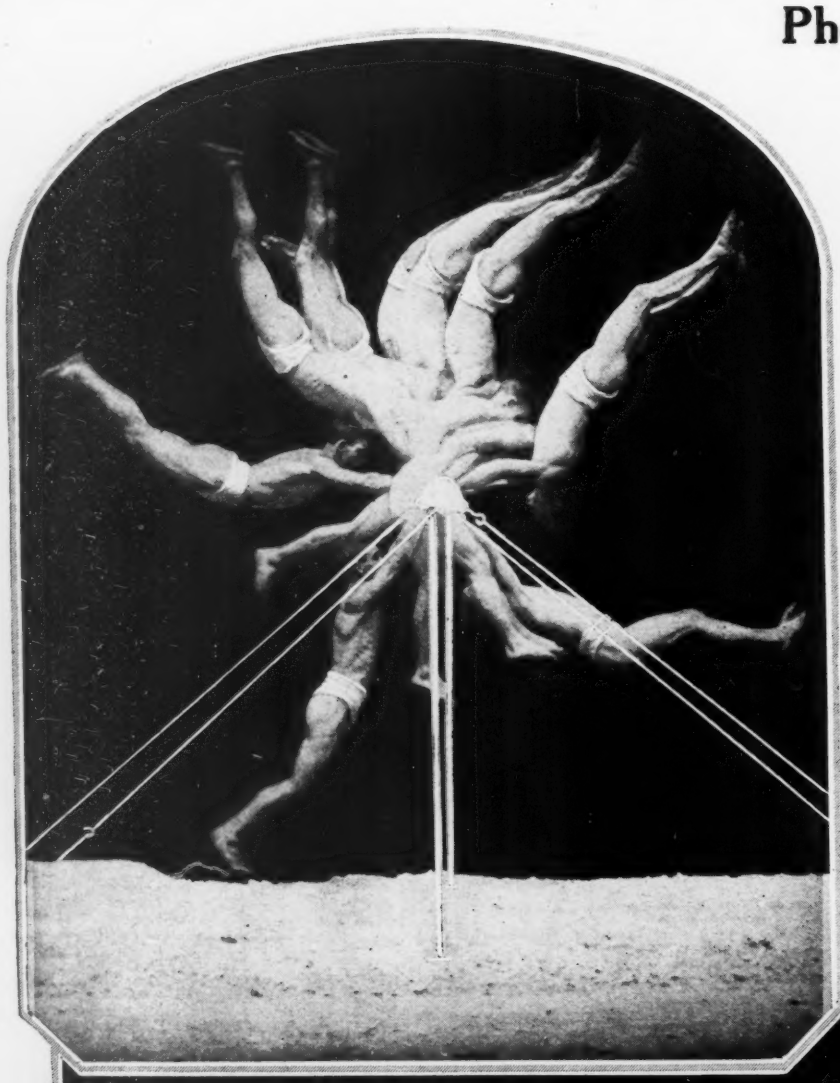
Developing Athletes with

Photographed on one plate,

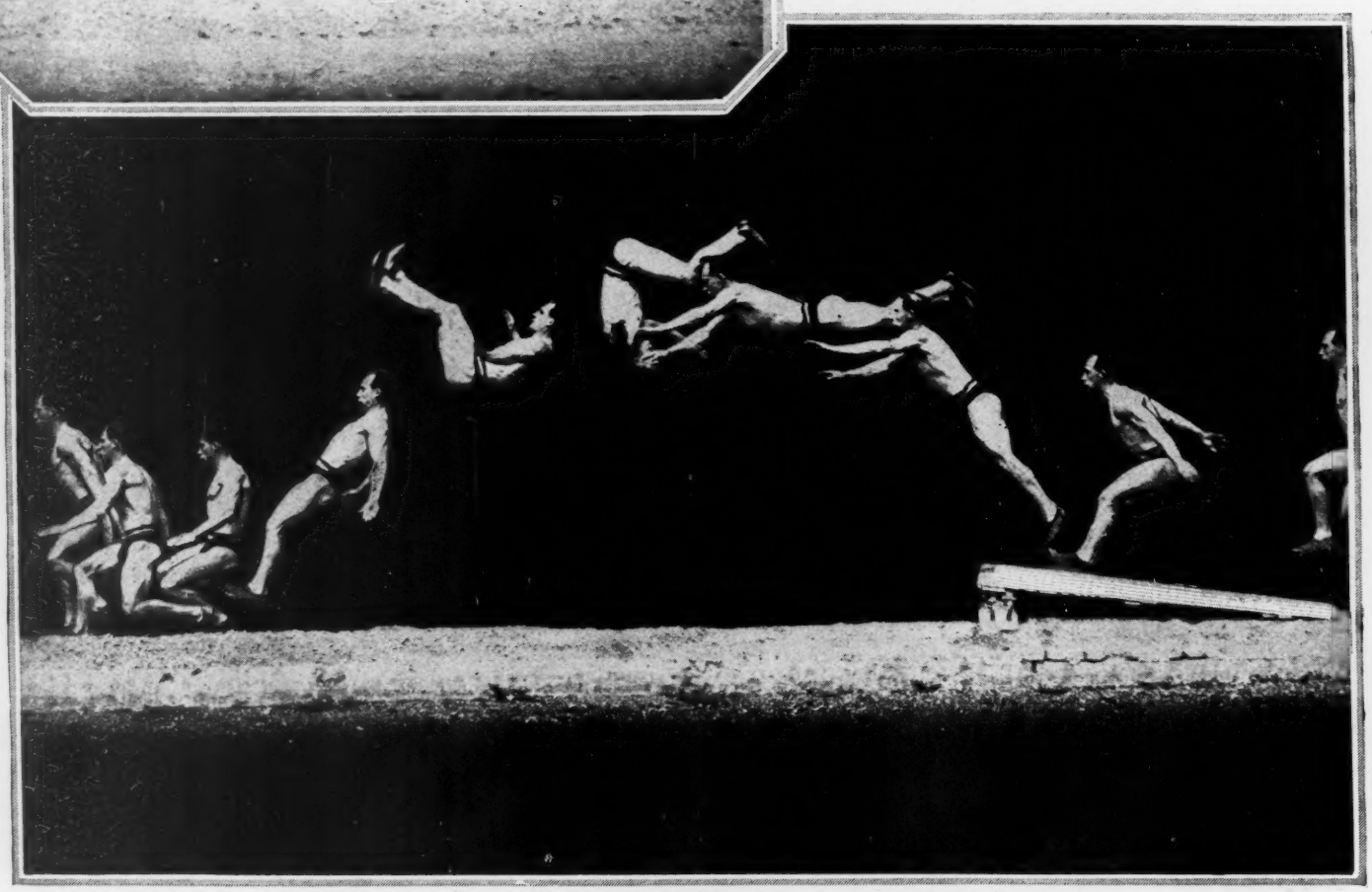
The first successful attempt to photograph action was made in Paris more than twenty-five years ago, when Muybridge set up a battery of twenty or more cameras, each focused on a moving person or object, and released the shutters in rapid succession at intervals of a fraction of a second.

Then came the motion-picture camera; but the new method, although in many respects superior to Muybridge's multiple-camera method, had two serious faults: it was expensive and wasteful, and each picture was separately made, so that it was difficult to use the pictures for comparison.

Some years ago a French inventor named Marey materially improved the methods of obtaining photographic records for the study of motion. Marey uses a single camera provided with an



This human spider is one man, photographed as he swung around a bar. After studying his motions in this picture the athlete's next "giant swing" was a great improvement



These photographs were taken by the new Marey apparatus that will take a whole set of movements on one plate. The ten men you see in the picture below are really one man

the Help of the Camera

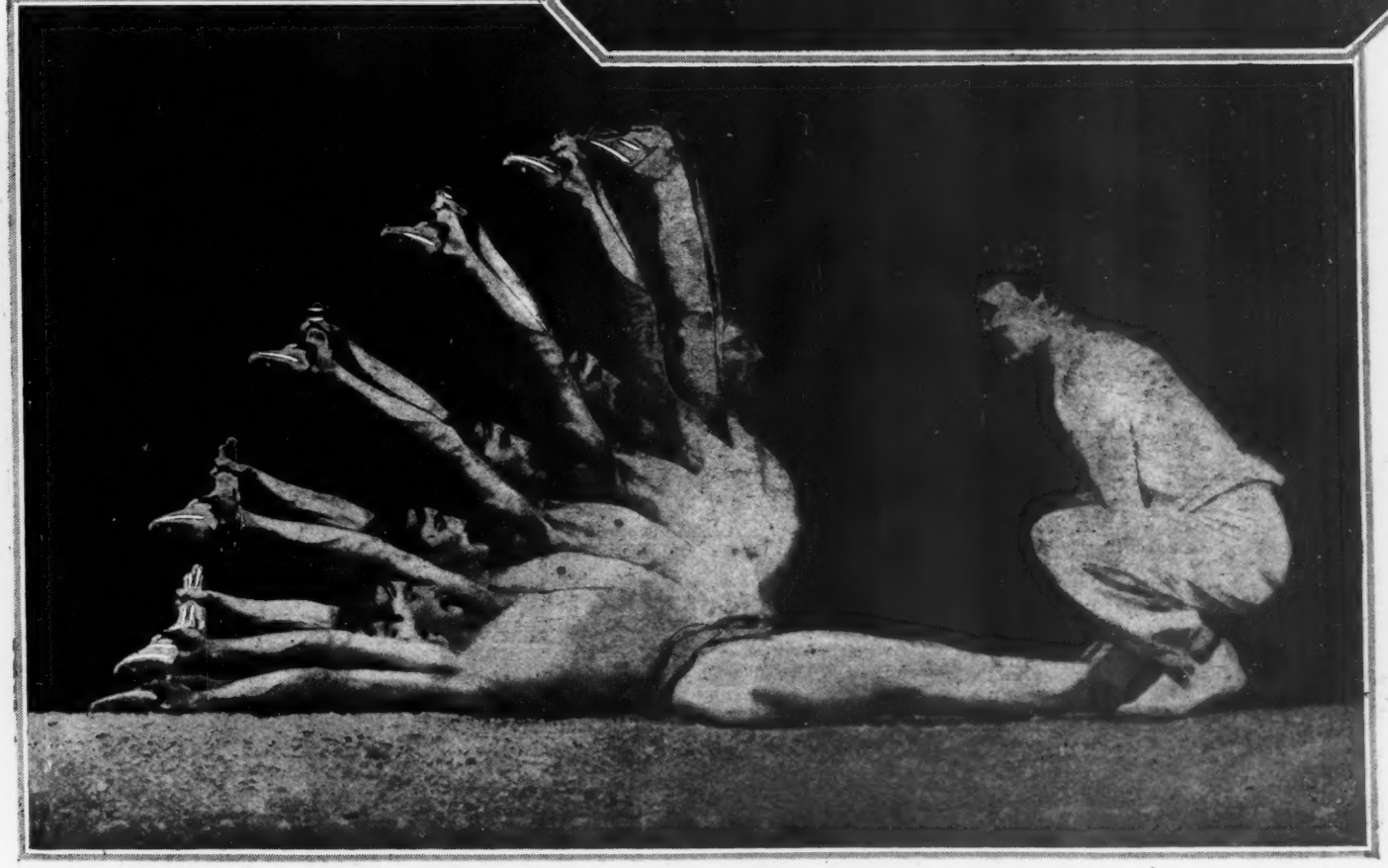
they resemble moving-pictures

automatic shutter, which is set so as to open and close at regular intervals, making a series of exposures of the moving person or object on the same plate.

What appears to be a group of persons is in reality a series of photographs of the same person, showing in chronological sequence the positions of the moving subject at predetermined intervals. The pictures are taken against a non-reflecting black background, while a strong light is thrown on the moving subject.

These photographic studies can be used in training factory workers and athletes. Looking at a series of his own motions, an athlete can see what mistakes he makes, and correct them.

The proper way to lift a heavy dumb-bell is demonstrated here. The photographs were made slowly on the single plate instead of in rapid succession, bringing out each movement



The instructor held the athlete's feet while he exercised his abdominal muscles. The camera clicked seven times as the athlete raised himself to a sitting position. The result is weird

Launching Ships by Machine

A mechanical hammer knocks out the retaining wedges

By **Joseph Brinker**

THERE is more to the launching of a ship than the breaking of a bottle over her bow, the signal to the workmen to let her go, the cheers of the crowd, and the final splash into the water. Down under the bottom of the ship, several hours of hard work by gangs of twelve or more men must be done before the vessel is started on her way to the water. And it is of this generally unknown work that this article is written.

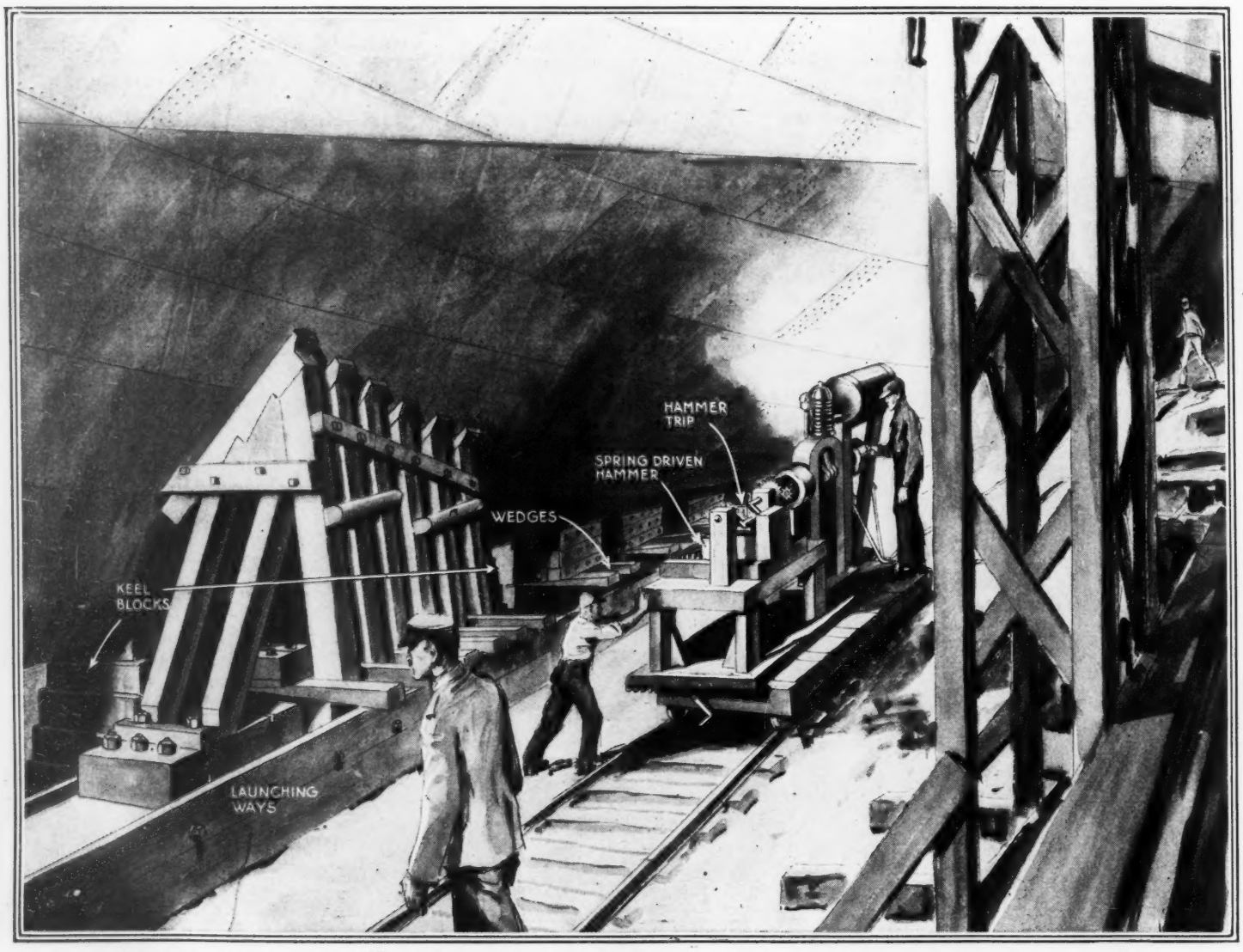
When the United States Shipping Board undertook to build a great American merchant marine to offset the peril of the German submarine, it listened to every new idea put forth to speed up any phase of the work. As a result, we are to-day building steel ships, and doing it more rapidly than it is done anywhere else in the world. Yet, with all the improvement in shipbuilding, the launching of vessels has remained virtually unchanged for the past three or four decades.

It fell to Joseph N. Borglin, of Seattle, Washington, to speed up launching by introducing a machine, operated by a gasoline engine, that eliminates the slow and hard hand labor heretofore necessary. Mr. Borglin's machine does away with driving up the launching wedges by hand-hammering and substitutes a mechanical hammer which is more certain and much quicker.

There are five main steps in the building and launching of a ship by the endways method now universally employed, except where the water at the point of launching is very shallow. The weight of the ship is first supported by keel-blocks laid lengthwise of the hull along the longitudinal centerline and under the bottom plating, and by side shores placed along the sides of the bottom plating where the hull curves from the horizontal bottom to the vertical sides. In this position no provision is made for launching.

After the ship has been sufficiently completed to launch, longitudinal stationary ways are laid on the ground on either side of the keel-blocks and parallel to them. These ways remain permanently on the ground and are covered with grease on the top. Next, the launching-ways are placed directly on top of the stationary ways and bolted to the latter at the forward end near the bow of the ship. These launching-ways do not yet touch the hull of the vessel, and the weight is still carried on the keel-blocks and the side shores.

To launch the ship, its weight must be transferred from the keel-blocks and shores to the launching-ways. This is done by filling in the space between the tops of the launching-ways and the hull with wood blocks and wedges driven up from the

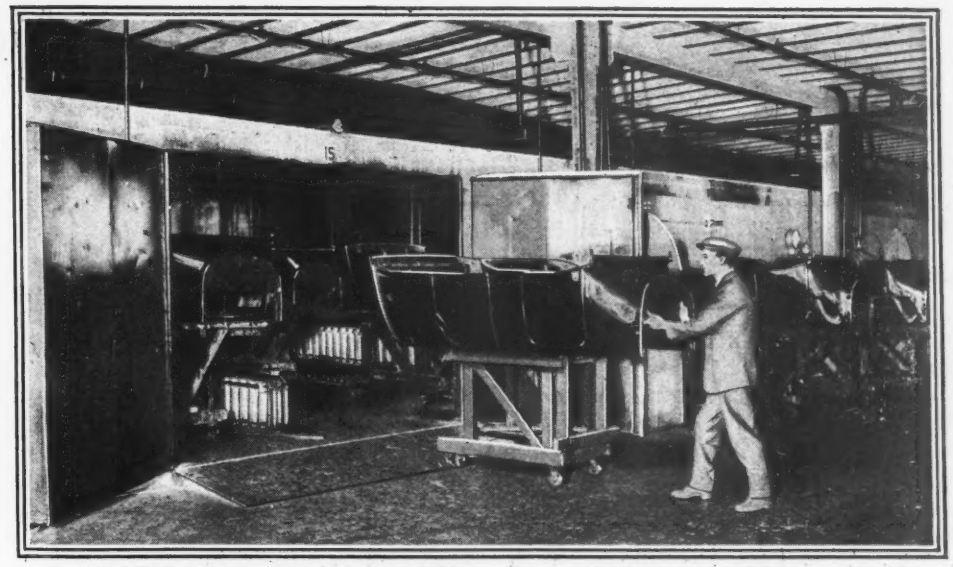


The automatic hammer at work driving the launching wedges. This method of launching a vessel is much more rapid and more certain than the old method in which gangs of twelve or more men were employed doing the work by hand

outside. By driving up corresponding wedges on each side of the ship at the same time, the entire vessel is lifted clear of the keel-blocks and thus supported on the launching-ways. The keel-blocks are then knocked out and the side shores removed. The actual launching is started by cutting the connection between the launching-ways and the stationary ways either by sawing off the bow ends of the launching-ways or by means of one or more types of trigger devices. The ship then slides down into the water on the launching-ways.

The driving up of these wedges takes time, for they must be hammered gradually so that too great a strain is not put upon any point of the launching-ways to crush them. The work is generally done by two gangs of men, one on each side. The gangs start at the stern and move forward at the same rate of speed, driving up each wedge in turn with a few taps of the hammer and then returning to the stern and starting all over again until the weight of the vessel is lifted clear of the keel-blocks.

Instead of this hand-work Mr. Borglin's machine employs a small mechanical hammer, mounted on a platform moved lengthwise of the ship on rails laid on the ground. Each hammer is alike and consists of a small gasoline engine mounted on a horizontal table built up on the platform. Through a set of gears the engine revolves a shaft provided with an offset or crank suitably supported on bearings. As this crank revolves, it catches the outer end of a rectangular stepped-off block of metal or hammer made to move in and out in grooves on the table-top and forces the hammer outward. As the crank automatically disengages from the hammer when it passes over the dead center of its stroke, the hammer slides inward striking the wedge a sharp blow.



Automobile bodies are heated before they are given a dip in a tank of japan and then they are baked in an electrically heated oven. That's what gives them their high finish

How Your Automobile Gets Its Shiny Coat

A NEW automobile gets its brilliant finish in an oven. It is dipped in liquid japan and then baked. The process is simple, but dangerous. After several automobile bodies have been japanned and baked, the accumulated fumes in the hot oven may cause an explosion.

There is a new kind of japan known as water japan. It is an emulsion of asphalt, linseed oil and water. Of course, the asphalt and linseed oil don't dissolve in the water, but they mix well and have no tendency to settle. Also the danger of explosion is removed.

There are two methods of applying the japan—one for small articles and the other for large ones. Electricity plays an important part in the first method. The article is positively charged and then dipped into a tank of japan negatively charged. An even, smooth coat of japan, free from solvent, is deposited.

Automobile bodies, etc., are heated before they are dipped into the japan. This frees them from grease and dirt, and then causes the japan to form a deposit on the metal as if it had been given a positive charge.

Automobile-license tags are given a coat of japan and then baked in an electric oven

A Knowledge of Chemistry Saved This Man's Eyesight

"I'VE got something in it," you say as you hold your aching eye and run to the doctor's. That something proves to be a tiny, almost invisible, speck; yet it felt like a nail, at least.

Imagine, then, the sufferings of a chemist in whose eye fifty small pieces of metal were embedded! He had been working near a tank containing hydrogen at two thousand pounds pressure. A defective valve caused the safety diaphragm to blow out, and many of the small pieces flew in the corner of his right eye.

The doctor tried softening the cornea in the hope that the metal pieces would drop out of their own accord. But they didn't.

When three weeks had passed and his eye was no better, the chemist thought he'd try a remedy of his own—removing the metal by amalgamation.

He purified some mercury by treating it with nitric acid and then redistilling it. Next he got out his eye-cup and applied the mercury to his eye. Almost immediately the fine projecting points of metal began to disappear into the mercury. He repeated the applications, using fresh mercury each time. Within two weeks the eye was normal.

Mercury is that strange liquid metal that is not wet. If you heat mercury or dilute it with an acid and mix it with almost any metal except iron and platinum, the two will combine and form an alloy known as an amalgam.

After suffering several weeks from tiny pieces of metal in his eye, a chemist evolved a mercury cure of his own with great success

Carrying the Power on a Separate Boat

How a floating power plant solves the problem of propelling a boat by electricity

By Latimer J. Wilson

"ALL aboard!" A peculiar thrill always accompanies these words. Visions of scenes in strange lands, or of new regions to be explored, flash before the mind's eye and fire the imagination.

Visitors who step aboard the yacht, the *New Era*, have an added thrill, when they know that they are to make a voyage upon one of the most remarkable of boats. From the deck they see, near by, another boat called the *Dawn*. This boat is connected with the *New Era* by a flexible insulated wire cable for conducting an electric current to the last-named boat.

"Two boats that act as one," exactly describes the distinguishing innovation invented by Mr. William T. Donnelly, a yachting enthusiast and an engineer. The *Dawn* is equipped with all the machinery necessary to furnish electric power for all the requirements of both boats. It is a floating power plant which will accompany the *New Era* upon all of its voyages; one boat to carry the heavy machinery and fuel; the other to be exclusively used by the passengers.

The *New Era* is unencumbered by the motive equipment, crew, and stores which ordinarily take up a large part of the space in a yacht. This provides room for more comfortable living quarters, and actually enables one to travel upon a boat which is really unsinkable, as will be seen.

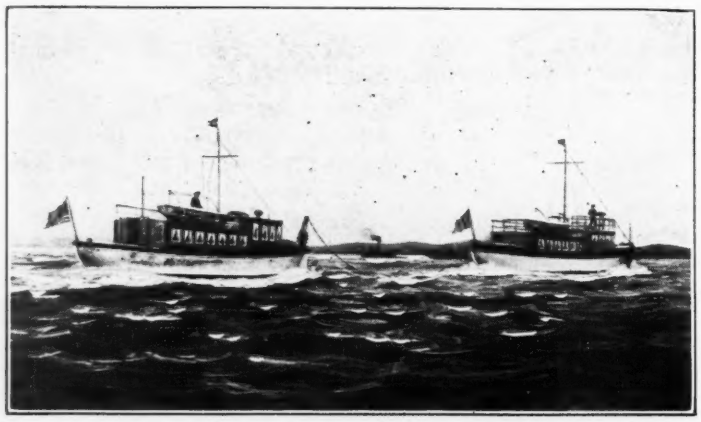
The after cabin of the *New Era* is a room 9 by 12 feet. Instead of the usual transom seats, a full-size davenport makes a comfortable couch for the day. Opened at night, it becomes a double bed. There are large closets for wraps and coats. There is a combination dresser with mirrors; and toilet facilities are furnished in two locations aft, the water-pressure being provided by an automatic air compressor worked by electricity.

The pilot-house is about 9 by 10 feet and across one end is a davenport similar to that of the after cabin. Under the forward deck are two berths such as are found in other yachts. There is ample locker space throughout. A current of 110 volts provides electric lighting. Storage batteries are used when the boat is at anchor, or when the floating power plant, the *Dawn*, is not connected with the yacht. In the *New Era* one will find electric heating, cooking, and also electrically provided means of refrigeration.

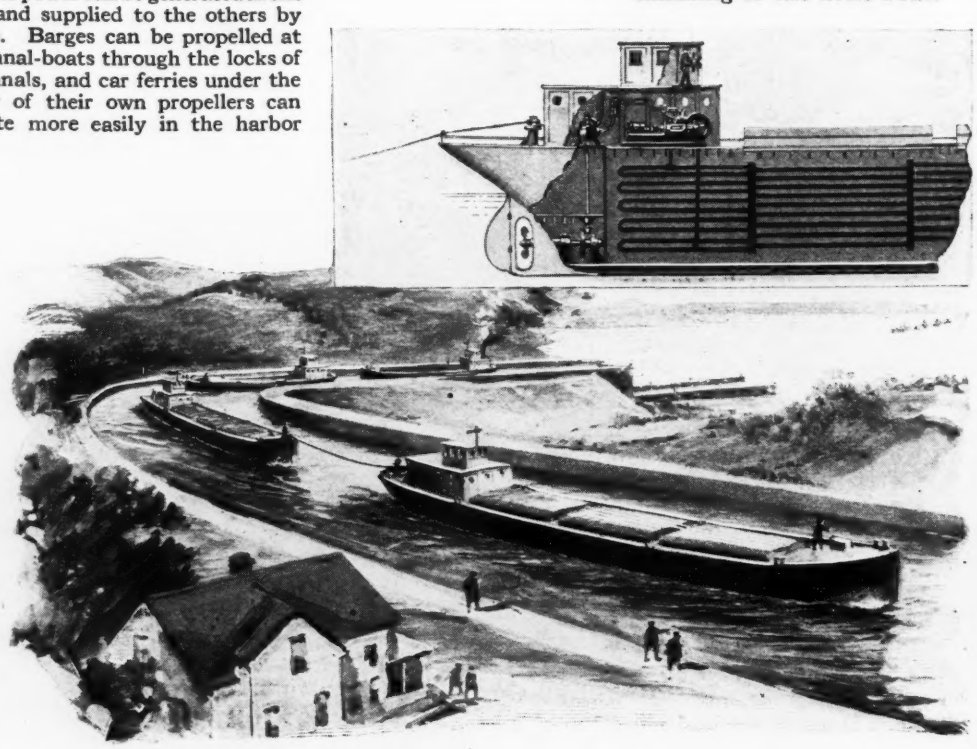
The innovation started with this pleasure yacht opens a new era for the maritime future. In no distant day one may see a string of electrically propelled canal-boats crossing the green meadows along the line of the sky-reflecting waters of the canals. Why continue to have the canal-boats pulled along by a tug, when a floating power plant can do the work better? Cables connecting the members of the flotilla will enable each boat to move with the force of its own propeller.

The ease with which the *New Era* has passed through the locks of the barge canal has demonstrated how satisfactorily the ordinary canal-boat can be made to travel with electric motive power. It is not a wild dream to imagine even a more far-reaching application of this mode of furnishing power.

The *New Era* is possibly the first attempt to make a power boat of its size unsinkable. The cabin floor is placed six inches above the waterline, and all the vacant space below is arranged with airtight copper tanks. To lighten the craft and aid in the unsinkable quality, the irregular parts of the vacant space below the cabin floor are filled with balsa wood, a tropical material lighter than cork. The frames, keel, stem and stern are of selected white oak. The planking below the waterline is of cedar; that above the waterline is composed of long lengths of Oregon fir. Mahogany is used entirely in the finishing of the little boat.



The boat in the lead in the picture, the pleasure yacht *New Era*, is furnished with electric motive power by the *Dawn*, following in her wake. The idea of one boat accompanying another as its power plant is original

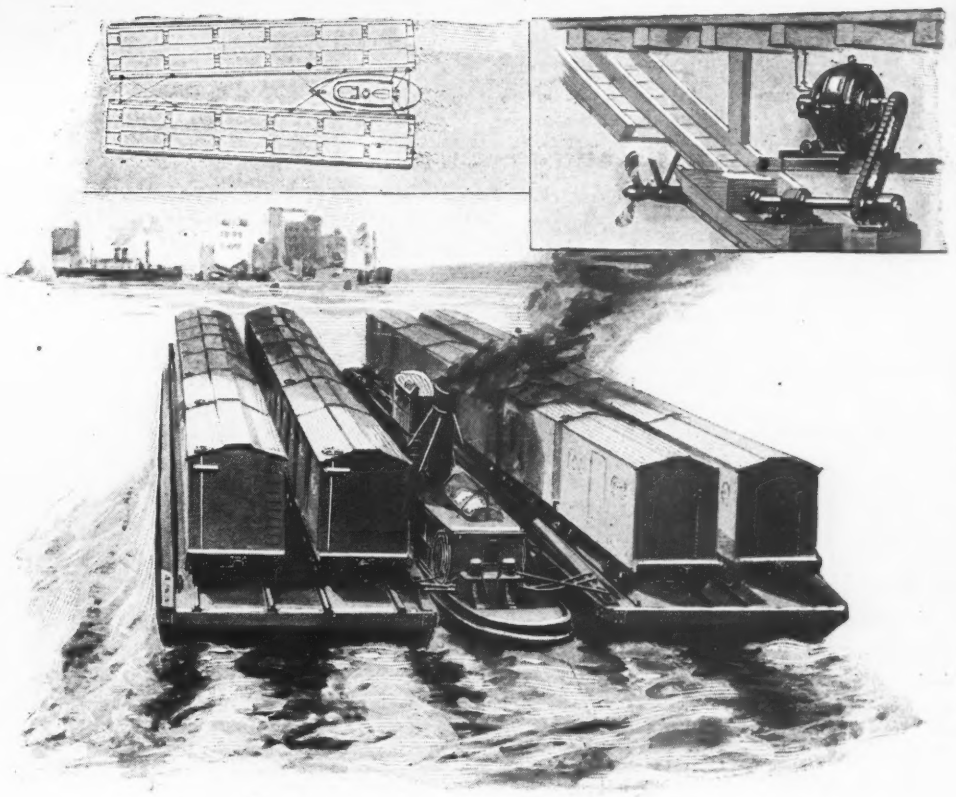


Electric power can be generated in one boat and supplied to the others by cables. Barges can be propelled at sea, canal-boats through the locks of the canals, and car ferries under the power of their own propellers can operate more easily in the harbor

To illustrate how near the perfection mark as a non-sinking craft the *New Era* has attained, Mr. Donnelly opened a hole in the bottom of the boat, which permitted the water to flow freely in.

The water poured in until it had reached a point measured both inside and outside by a bare two inches of increased draft! The *New Era* went down only two inches and sank no farther.

The principle of this construction carried out on the large scale of an excursion steamer would make a craft of this type safe to a degree not heretofore thought possible. By removing all of the heavy machinery from the steamer the first step is taken in making the craft lighter. Such a boat at the piers of the crowded city sweltering in summer heat, would offer a welcome relief to those who would enjoy the breezes of the water. There would be plenty of room aboard for refreshments, music and dancing. With no furnaces, the danger of fire on such an excursion boat would be minimized.



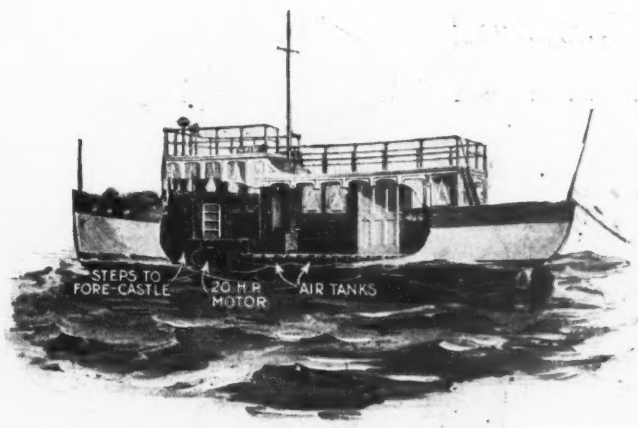
Even car-floats can be equipped with motors and propellers, and, furnished with current from a floating power plant, they may acquire greater speed

One of the most clumsy specimens of harbor craft is the car-float, slowly plying its way under the guidance of tugs. Freight-trains of different lines loaded for the necessary transfer from terminal to terminal occupy the deck of these ferries. Instead of the tug furnishing all of the propelling force for these clumsy floats, the new power boat would be of much service. It could generate the electricity which the cable wires would transmit to the motors with which each float would be equipped. Thus, under their own propellers the car-floats with their loaded box-cars could make better time and be more easily controlled in their trips across the harbor. When motor-trucks become the more general means of freight-transfer special ferries will likely be designed to accommodate the greatest number of trucks. Here the use of electric power generated to fulfill the ferry requirements will be an aid to the quick transfer of freight.

From the small power yacht to the largest ocean steamship, the final results of the experiment which began with the building of Mr. Donnelly's *Dawn* may ultimately be applied. It is not impracticable to utilize one boat as a power station supplying electric power to another. On the high seas, where huge waves make the towing of vessels a difficult and a dangerous undertaking, the cable can be lengthened. The time may not be far distant when the wireless transmission of power will be tried. Then two boats need not be physically connected.

The motor which turns the shaft of the *New Era* is capable of twenty horsepower. It is practically noiseless, enabling the yacht to glide through the water without any of the vibrations characteristic of the machinery of a power-boat of its size. The motor is mounted under the floor of the wheelhouse. To prevent the water reaching either the motor or the exposed electrical parts, the whole motor is in a water-tight box.

The boats are connected by telephone and are equipped with searchlights and wireless. They can make nine miles an hour in speed. The *Dawn* is provided with an auxiliary set which will generate four kilowatts of current for one hour, consuming a gallon of gasoline. This gives 4000 watts of electricity for the price of one gallon of fuel.



A diagram of the *New Era* showing the copper air-tanks which make her unsinkable. Note the absence of all machinery except the 20-horsepower motor

Look into the future and see a far reaching application of the principle set forth in these little crafts. Already scientists have begun experiments in the wireless transmission of power over short distances. If the principle can ever be applied to long-range transmission, then a remarkable scene will be witnessed by the trans-atlantic voyager of the future.

On the seas ships of all kinds will be coming and going. There will be palatial steamships upon which no heavy engines or massive coal bins will be required. Every inch of space will be available for cargo and passengers. Only the motors operating the propellers will be in the vessels' hull. The ships will be unsinkable, and will be equipped with every convenience. Strange ships they will be without smokestacks. More remarkable still is the method by which they will be furnished with electric motive power.

Strung across the sea at regular intervals will be the floating power-generating stations. These will be boats which are in every way complete in the mechanism which they require. In this forecast, though, one must assume that the matter of liquid fuel has been solved, and that these power-plants at sea can be readily supplied.

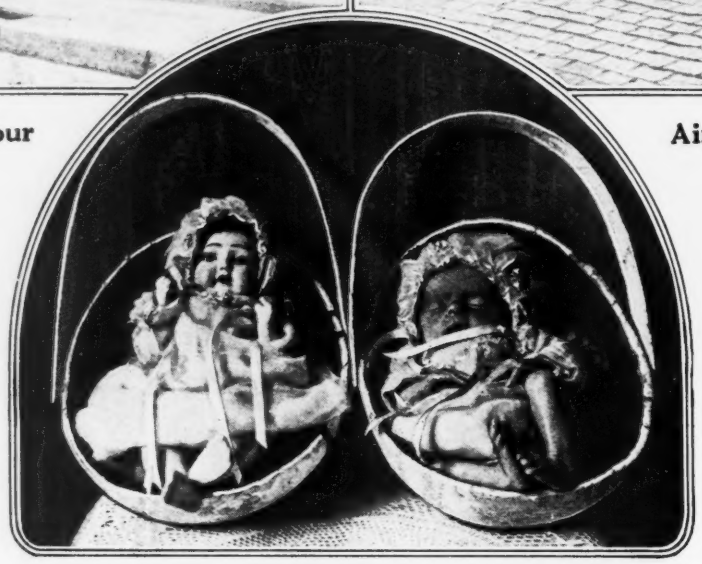
Do People Cut Across Your Well Kept Lawn?

"LOOK at that path across our lawn!" moaned the owner of an attractive bungalow situated on a street corner. "It is completely spoiled by people making a short-cut over it, and lumber is too expensive for me to build a fence. Besides, a fence detracts from a garden's beauty."

Why not build a fence set at an angle across that corner? The suggestion was taken, and the fence shown in the picture was built.

But some will overcome this obstacle to a short cut by leaping the fence, you will argue. The owner of the fence doesn't agree with you. And he seems to be right, for his lawn stays in an ideal condition.

How much lumber did this man save building a diagonal fence instead of a right-angled one? Consider the problem from a geometrical viewpoint: The diagonal fence is the hypotenuse of the right triangle formed by the imaginary right-angled fence.



Seven Weeks Old and Weighs Only One Pound

JEANNE OUSSET is quite the smallest person in the world. At present she weighs just one pound, and she is already seven weeks old. When she was born she weighed one half as much, and doctors declared that she couldn't possibly live. But she is alive and kicking—just like any ten-pound baby.

Jeanne's doll is larger than she is and the doll's clothes are entirely too big for her. Both of them are shown here side by side. Her doll is much more wide-awake than Jeanne is, but that won't last for long. Jeanne is improving every day and will soon gain another pound.

Air-Projected Powder Puts Out a Gasoline Fire

TESTS with a fire-extinguisher based on a novel principle have recently been carried out in Berlin. Burning gasoline, oil, etc., or fires due to short-circuiting cannot, as everybody knows, be extinguished by using water. Water spreads such a fire.

The new apparatus uses a powerful and uniform jet of powder projected by compressed air.

The conduit which supplies the compressed air is so designed that the latter stirs the powder thoroughly, the jet making a dense cloud above and effectively putting out the fire.

The steel bottle containing the compressed air is fitted in the interior of the powder-tank and accordingly is always surrounded by an ample layer of powder, insulating it against the influence of variable temperature.

This apparatus takes up very little space and is entirely automatic in working.

In the Lion's Mouth with a Brush

HOW would you like to clean a lion's teeth? That was the job assigned to a London cleaner and he accepted it with calm indifference. But, of course, the lion in question was a metal one and his teeth were quite harmless. In fact, the lion whose teeth he cleaned was one of those famous lions that guard Nelson's monument in Trafalgar Square.

Once a year the lions are given a thorough cleaning and polishing. A ladder must be used to reach the lions' ears, but the teeth can be tackled from the base, as the illustration shows.

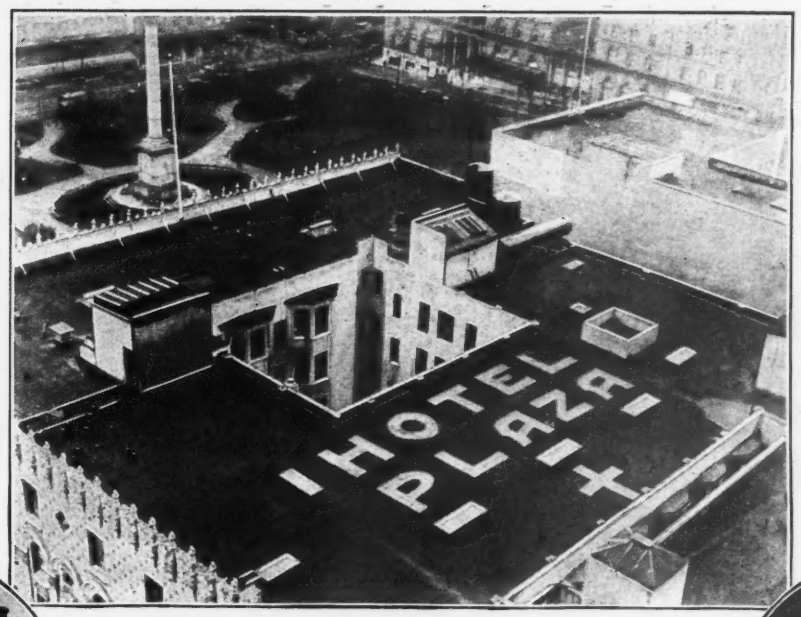
These great bronze lions were modeled by Sir Edwin Landseer. He started work on them in the year 1859 and did not finish them until 1867. Each one is twenty feet long and weighs seven tons. The final casting was done by Baron Marochetti.

The statue of Nelson which the lions guard was made by E. H. Baily. The statue stands on a granite column, 145 feet high, copied from the temple of Mars Ultor in Rome.

Who Wants To Be a Music Conductor?

DO you want to be the conductor of your own phonograph? Play a record on your phonograph, then slowly shove a small feather duster or a silk handkerchief into the mouth of the tone-chamber. Doesn't the tone become muffled and softer? Draw the duster or handkerchief toward the opening and the melody increases, crescendo!

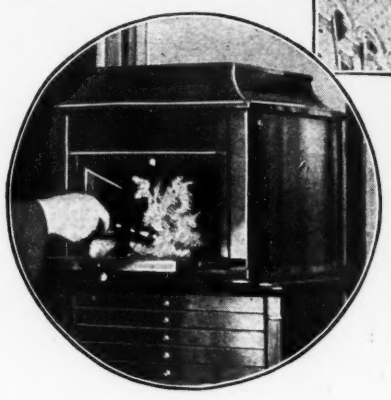
If the loudness is annoying, push the duster or handkerchief back. How faint the music! Crescendo or pianissimo, as you like it.



A Mechanical Card-Dealer for You

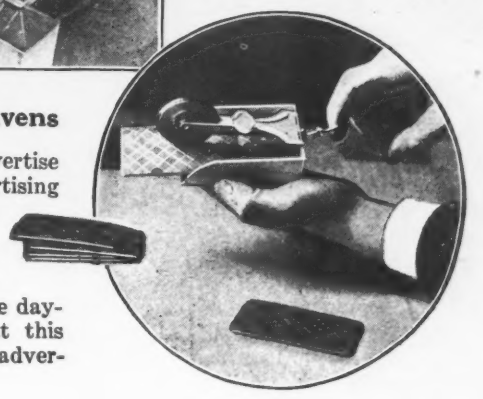
THIS is a French invention for rapidly dealing cards. It consists of a metal tray large enough to contain a pack, and a wheel kept in contact with the top card by a spring. Connected to the wheel is a chain to which is attached a wire ending in a loop. When the wire is pulled, one card is dealt, the spring bringing the wheel into contact with the next card.

In spite of its ingenuity, imagine the courage required to introduce this invention to old card-players.



Advertising for Denizens of the Heavens

HERE is a hotel that is glad it has a roof to advertise on. But what good can this kind of advertising do? A great deal. In the first place, the hotel in question is situated in San Francisco, and, in the second place, San Francisco is the center of quite a bit of airplane traffic. The huge sign and the white cross shine up at the aviators in the daytime and at night and suggest their stopping at this hotel. Surely aviators are struck by this novel advertisement and their admiration aroused.



The Circular Saw Consults Its Own "Dentist"

THE sawmill man can be a "dentist" for his own circular saw, whose teeth have become bent and out of line. Making hundreds of revolutions a minute, the teeth must conform to the desired curvature or they will strain the metal disk and waste lumber.

A steel frame supports the saw, and this carries a straight edge and a tension gage for testing the curvature.

The support is designed to hold the saw while it is being tested and also while being hammered to remove imperfections and make them conform to the curvature. The device provides for an anvil to be placed beneath the parts of the saw that have to be hammered into shape.

Any one having experience in the mill can thus straighten and tension his own saws, saving the expense of having it done by a special workman.

A Clothespin for Your Newspaper

"LOOK at that!" exclaimed Mr. Brown as he looked out and saw what had happened to his morning paper, scattered all over the front yard from the steps to the hedge beside the pavement. The next day the newsboy was instructed where to put the morning paper so it would not blow away.

A clothespin was the magic charm which was to save the day, one of the kind which takes a tight hold upon whatever is placed between its clips. It was attached to the front-porch post.

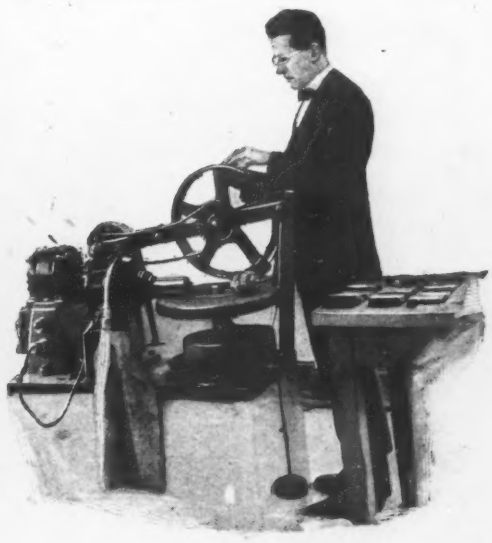
The newsboy sticks the paper between the tight jaws of the clip, and the paper is held high above the damp ground. Only a very strong wind can do it much damage.

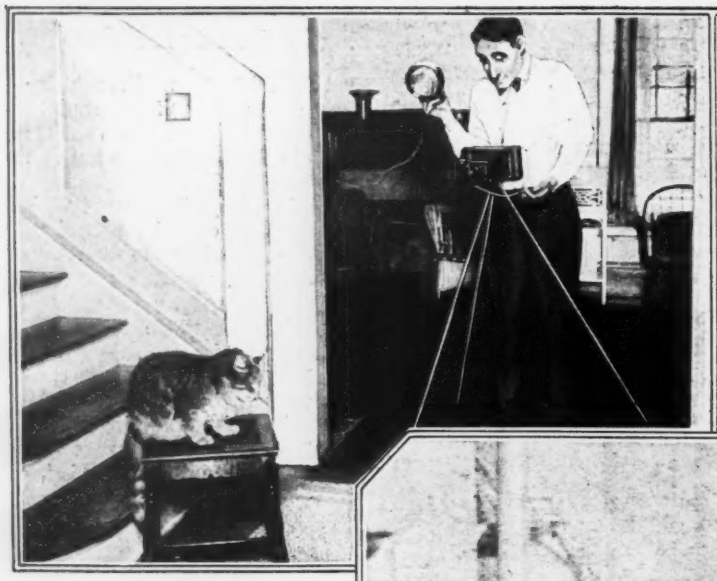
"What a relief to find the morning paper where it is, all together, and not blown about the front lawn!" says Brown to himself every morning when he steps out to bring in the paper. "I'll give that newsboy an extra quarter for his Christmas present."

Are Your Shoes as Durable as They Should Be?

WHAT are the effects of Epsom salts and glucose on the wearing quality of high-priced shoes worn today? What portion of cowhide is most durable as shoe-leather, and what is the comparative durability of leather tanned by minerals and that tanned by vegetable extracts?

The Bureau of Standards has devised a machine for testing the various kinds of leather. Hemlock-tanned leather in which glucose and salts have not been used, and that in which a ten per cent solution of these materials has been used, have been compared with oak-tanned leather





An Automobile Lamp for Taking Pictures

PUSSY simply refused to pose for her picture while the sun was just in the right spot. But as soon as Old Sol had departed westward and the light in the room had become dull, she was as willing as could be. Her master, knowing her well, had expected exactly that sort of contrary behavior, so he was fully prepared for it.

With the aid of a transformer he connected his automobile searchlight to the electric-light socket in the wall. He turned the light full on the cat and snapped her picture, holding the light in his right hand a short distance behind the camera, which was placed on a tripod.

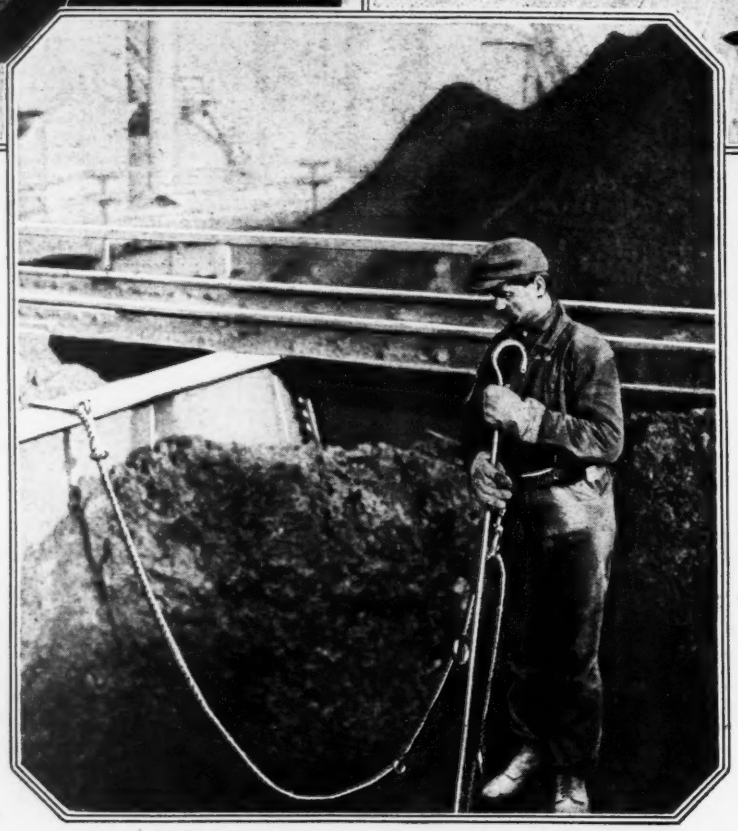
Being in the spotlight doesn't seem to disturb pussy at all. But we hope that on a dark night she will take more interest in headlights and spotlights. Dead cats are not nearly as attractive as live ones.

A Safety Rod for the Swimming-Pool

IF you wish to learn to swim, go to a swimming-pool. You can see bottom and know what's down there. You have no breakers to worry about. Your instructor can see your every move and correct you more accurately than if you were floundering about in the ocean.

Above you see a new pool device for helping people learn to swim. It consists of a pole to which a leather belt is attached by means of two heavy ropes. The ropes pass through a loop at the end of the pole, and the pupil passes through the loop made by the belt and ropes. Thus he is allowed perfect freedom of motion. The instructor holds the pole as he kneels at the edge of the pool and holds up his pupil.

It is surprising how little effort need be exerted by the person holding the pole. The man above who is learning to swim weighs one hundred and seventy-five pounds and yet he is being supported by a fifteen-year-old boy.



He Wears a Safety Belt While He Feeds a Fiery Furnace

SHOVELING ore into a red-hot furnace is not a pleasant job—particularly when the furnace is below you and you are apt to slip into it. The man in the picture has just such a job, but he is roped to a beam so that if he slips he will simply dangle at the end of the rope. Rope or no rope, the job is not one we should choose.

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They May Look Alike, But They're Very Different

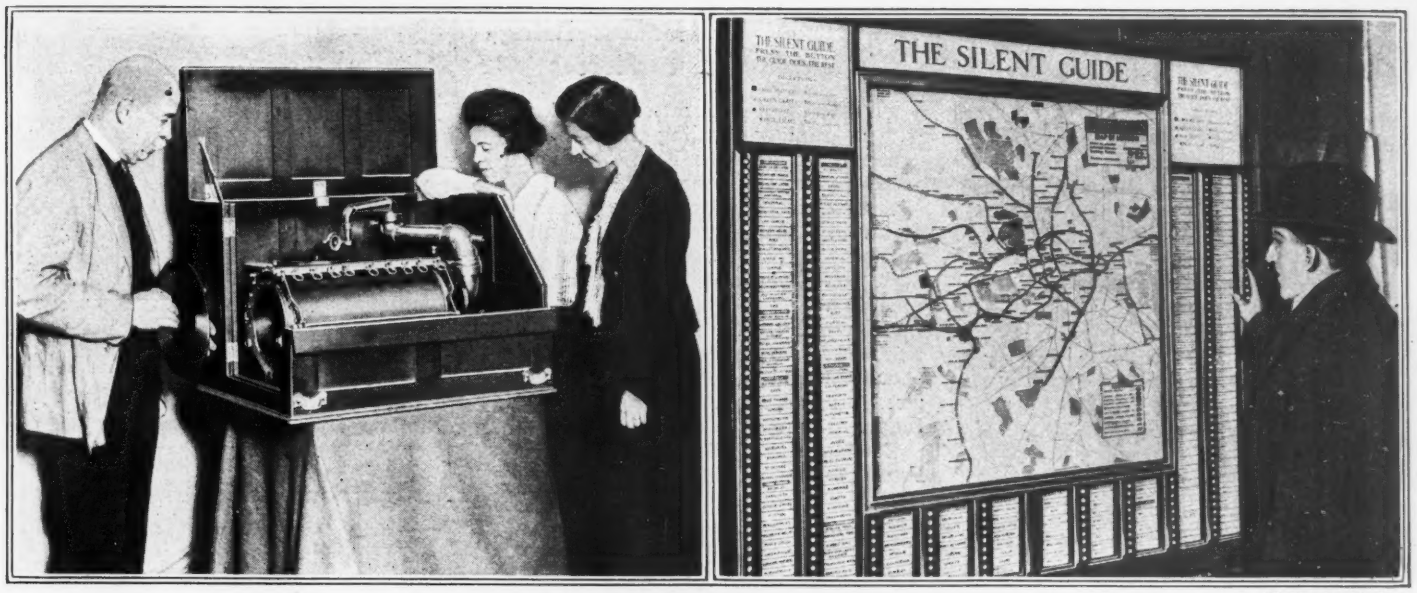
IMITATION diamonds are oftentimes difficult to distinguish from real diamonds. The same holds true of Panama hats. At first glance imitation Panama hats, made by machine and costing seventy-five cents apiece, sometimes resemble the real thing.

The hat on the left was made by hand and cost one hundred dollars.

This expensive hat was made at Montecristi, Ecuador. A great amount of labor was spent in its production. It was woven entirely by hand by natives practised in this work.

The hats shown in the picture on the right were woven by modern machinery, and, although they look like hand-made hats, they will not last as long.

©Kade & Herbert



© Kadel & Herbert

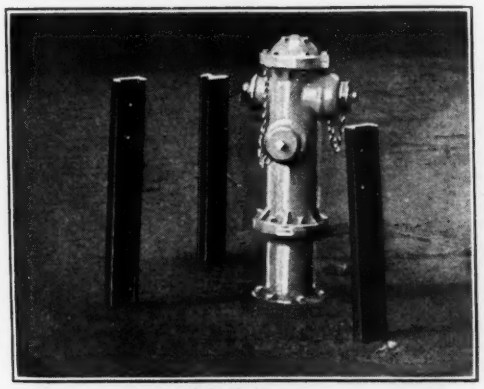
You Can Now Hear an Entire Opera on the Phonograph

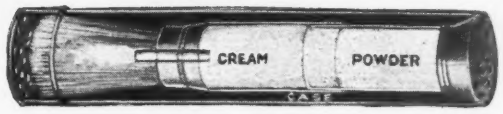
A PHONOGRAPH that will play an opera or symphony straight through without changing records, has been invented. For such an entertainment a ring-shaped record is used. The ring record is placed on a cylinder, which also serves as a long projection horn. This rotates and the needle of the reproducing apparatus travels along the cylinder.

The cylinder is long enough to carry nine or ten of the ring records, providing a continuous concert of an hour or longer. With this phonograph the ordinary disk record can be used. George W. Bowers of Somerville, Massachusetts, is the inventor.

A Protection for the Useful Fire-Hydrant

FIRE-hydrants stand perilously near the curbstone and are always in danger of being hit. Passing trucks with overhanging loads often take the covers off unsuspecting hydrants. That's why San Francisco has recently purchased several discarded railroad rails. These rails were cut up and three sections placed around each hydrant in triangular position. They do not hinder the hydrants in time of fire, yet they do protect them from the blows of every-day life sustained from automobiles and heavily loaded wagons.



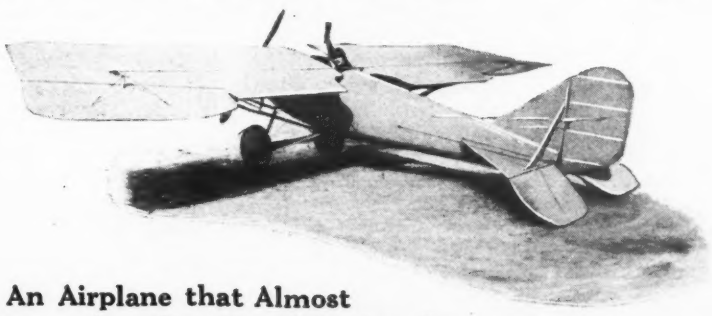


Have You Your Beauty-Box with You, Gentlemen?

HERE'S a clever device permitting a man a complete shave in the city or camp. The brush-bristles are fastened into a holder screwing into the main tube of the container.

In one part of this tube is a receptacle for shaving-cream, while telescoping into it is another section used for holding and sprinkling talcum powder.

After dipping the bristles in water a slight turn of the powder-container in the tube holding the cream, forces the shaving-cream through a center opening in the bristle-holder. A perforated revolving cap on the talcum-powder can permits the closing of the powder receptacle.



An Airplane that Almost Any One Can Afford to Buy

THESE mechanical butterflies are very small and very cheap. If you can afford to buy a six-cylinder car, you can certainly afford a "Butterfly."

Above you see a "Butterfly" just after it has made a successful trial flight at College Point, New York. The "Butterfly" is a monoplane weighing 595 lbs., measuring 19 ft. in length and 29 ft. wing spread. It is driven by a two-cylinder motor and has a capacity of 383 lbs.

Reducing the size of airplanes goes on apace, keeping step with its first cousin, the automobile. Soon we'll be ordering them by size instead of by name.

London's Substitute for New York's "Follow the Green Line"

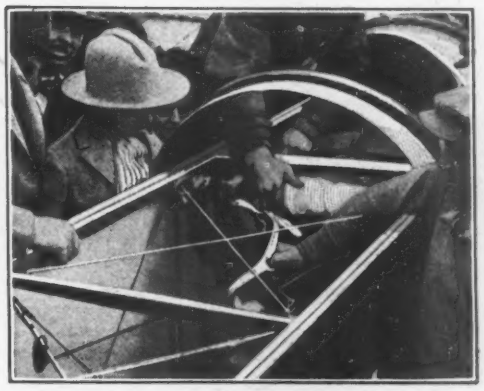
VISITORS to large cities struggling with complicated railway systems would appreciate the "silent guide," installed in London at the Leicester Square tube station. It is a map of London's subways around which are the names of well-known places with an electric button beside each.

Press the button that accompanies the name of your destination. Lo! four lights glow forth on the map. A large red light shows you where you are; a green light, where to change; a small red light, where you alight; and a white light, the location of the place you wish to reach.

The First Horse to Ride in an Airplane

PEGASUS, the flying steed of Olympus, has a rival in the horse that was recently taken up in an airplane. Moving-pictures were made, showing plainly how a "flying horse" is strapped in the fuselage of the aircraft.

Though taking a horse up in an airplane may seem a foolish performance, it has a deep significance. It shows that the ingenuity of man has actually conquered the ocean of the air. The modern heavier-than-air machine can be so constructed that bodies much larger than a horse can be taken through cloudland.

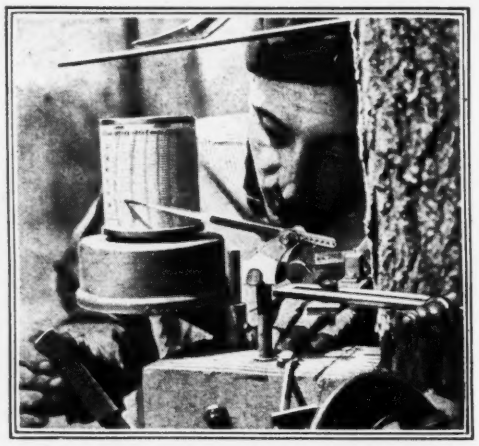


New Styles in Harness Bring Greater Ease to Horses

ALTHOUGH the automobile truck is rapidly stealing his job, the truck horse has not been overlooked in the matter of improvements.

A new kind of harness has been constructed. It is much easier to manipulate than the old, and disposes of the old-style collar and saddle, so uncomfortable to animals, distributing the pull more equally over the body. The animals have free action of their shoulders and legs, and in the tests already made, seem much happier with the new harness than with the old.

The inventor is a farmer from Orange Free State in South Africa.



An Instrument that Measures the Growth of a Tree

HOW tall does a tree grow in a week? The dendrograph is a simple device for answering that question. It consists of a collar and belt which encircle the tree and are attached to an arm holding a stylus which indicates on a rotating drum the gradations of measurement and time. The dendrograph is not sensitive enough to record the minute pulsations, "the heartbeats" of the living tree, but it accurately measures the fractions of an inch by which the growing tree overcomes the pulling force of gravity. Tree growth varies according to temperature and the species to which the tree belongs.

The Counter Printing-Press for Shopkeepers

THE enterprising merchant cannot get his name or his picture displayed too much in public. A simple printing machine has been invented which enables a storekeeper to print his name on the wrapper of every package taken out of his store.

The device will work automatically on bag, package, or box. It can be easily detached and by a rolling motion used to print the same or a different ad. The smearing of the ink, a difficulty that has heretofore presented itself, is prevented by a device which dries the ink.

This Palace Is the Realization of a Postman's Dream

BELOW you see the queerest palace in the world. The builder is a postman of Hauterives, France.

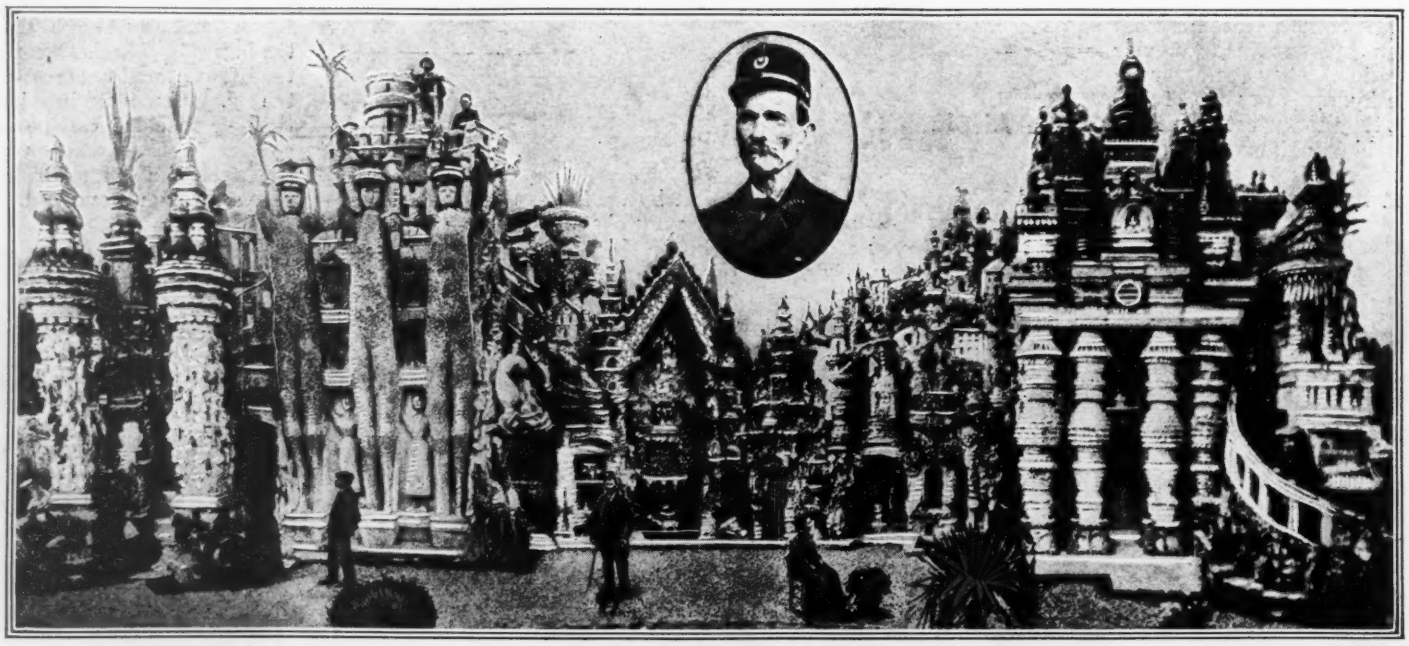
In the spring of 1879 Ferdinand Cheval found in the mail he was distributing an unaddressed volume dealing with architecture. It was illustrated with pictures of palaces, châlets, mosques, and castles.

Thereafter Cheval spent his nights poring over these pictures until there grew in him a great longing to have a palace of his own

After his day's work the postman gathered stones, sea-shells, and sand, loaded it on a barrow and dumped it on his quarter-acre of ground. Out of his meager salary he managed to save a little each week for cement and lime.

Recently Cheval finished his palace, after forty years of labor. But, after spending the best part of his life building his palace, Cheval still lives in his little white house at the rear.

Though laughed at for years as a madman by the rest of the community, Cheval, by reason of his strange palace, has put Hauterives on the map.



A Versatile Motor for a Lady's Boudoir

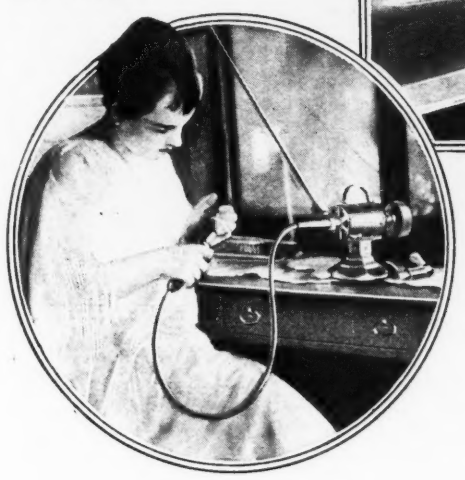
IN the domestic arts the small motor plays a useful and busy part. It runs the sewing-machine, it freezes the ice-cream, it washes and dries clothes, and it sweeps the floors. Now the small motor run by the house-lighting current can smooth the finger-nails and buff them to a pink polish.

The utility of electricity in small ways is coming more widely to the aid of those who would save the labor and bother of doing these things by hand. Such operation of the motor is often no more noticeable in the effect upon the meter than is the use of the current for reasonable lighting in the house.

A Straight Smoke or a Serpentine One?

THE whiff of a cigarette has a different flavor when it is drawn through a serpentine coil, according to Mademoiselle Dacia, the popular dancer, who uses this unique cigarette-holder made entirely of glass. A cool, soothing whiff of the "divine weed" exerts a spell upon the smoker which might well put some in a cautious mood. The combination of woman and serpent might awaken a sense of suspicion in Fancy's illusions painted in the blue wisps of smoke.

The winding course of the smoke through the coil causes condensation of the moisture.



A "One-Man Top" Is Lifted Easily

"CAN a man handle a 'one-man top' with ease?" "Surely," says Montague Love, well-known film star, "if he has a double," and demonstrates how a man and his double can put down a top.

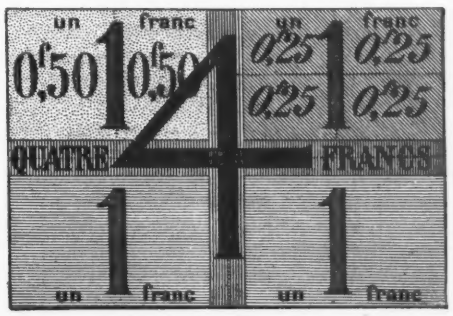
Two pictures were taken on one film, both alike in all details except the location of Mr. Love, in one picture standing at the right of the automobile and in the other at the left of it.

Merrily He Rolls Along on His One-Wheel Bicycle

PERHAPS it was to save shoe-leather or bicycle wheels—we do not know. At any rate, a Berlin business man appeared on the street one day riding along cheerfully on half a bicycle. Surely it can be no easier to pedal up and down than to walk—unless you are an ex-convict accustomed to the lockstep. But of course you are able to travel faster on a wheel than you are on foot.

The chief difficulty occurs at crossings. How can you stop wheeling suddenly and manage to maintain your equilibrium? In fact, your equilibrium must be in excellent condition throughout the continuance of your one-wheel-bicycle ride. This man appears to be very satisfied with himself and not at all averse to having his picture taken.

© Int. Film



A Government Divides Its People's Money

A BANK note capable of being divided into fractional values is issued by the French government to meet the metal-currency shortage. Perforations along a vertical line divide the four-franc note into two equal parts, while a horizontal line divides each of these, making four one-franc sections. One of these sections can be divided into two half-francs, another into four quarter-francs. To make change from a four-franc note, one or more of the sections is torn from it. When too many bits of the paper money are collected, they can be pasted together and treated as complete bills. The French are careful about destroying paper nowadays!

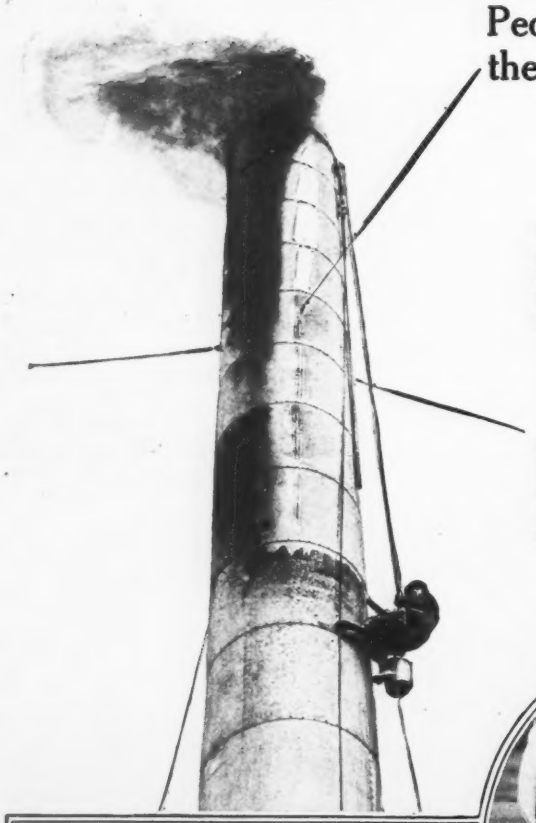
An Electric Bond-Tester for Use in Mining-Camps

AS seen in the picture, the electric bond-tester is a simple device.

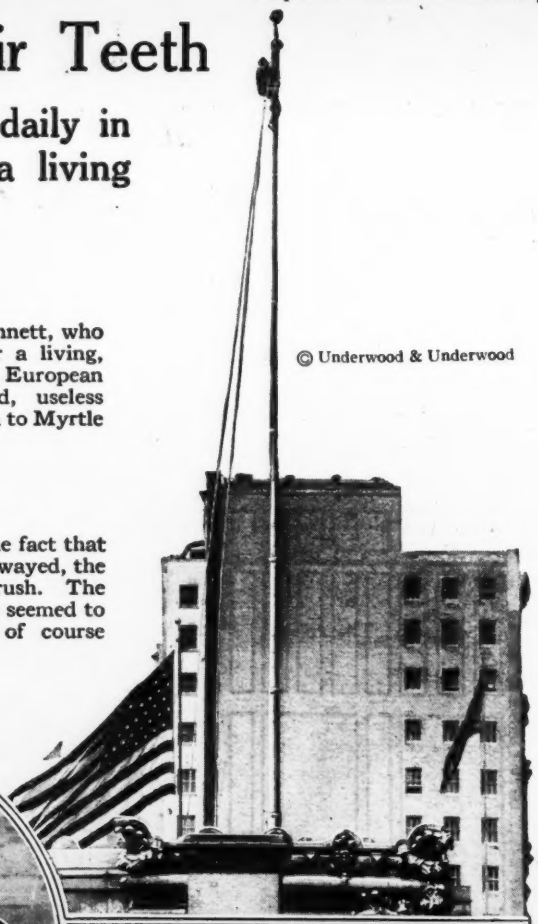
For use, it is placed as shown. A pair of drill bits bears upon each abutting rail. The switch in the tester's handle is closed, and by means of downward pressure the drill points rotate and cut rust or other material on the rail until the current is set up through the rail joint. In the lower part of the instrument there is a buzzer connected with the receiver at the workman's ear. If connection is poor, the buzzer will buzz; if good, there will be no buzzing.

By the Skin of Their Teeth

People who face death daily in the game of earning a living



To the left you can see Myrtle Kennett, who paints Cincinnati smokestacks for a living, and enjoys it. Where are those European writers who talk of the spoiled, useless American woman? Introduce them to Myrtle



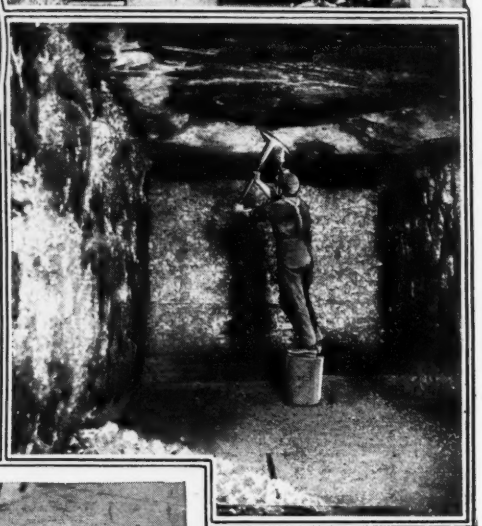
© Underwood & Underwood

At the right see how, in spite of the fact that the wind blew and the flagpole swayed, the intrepid painter on top plied his brush. The crowds below were thrilled, but he seemed to take his position as a matter of course

In a search for wheat lands, these intrepid men climb the treacherous slopes of mountains. One misstep sometimes results in a man's death. Climbers usually wear spurs to keep them from slipping

© Committee on Public Information

Loading shells is one of the most dangerous jobs in a munitions factory. In the event of a shell exploding, the loaders and supervisor would be its first victims



He's sounding the coal above his head. Should he strike a loose section it would fall and probably maim or kill him. More than nine hundred miners in this country are killed by falling roofs every year

© Underwood & Underwood

Cleaning statues is this man's job. If a statue thrusts out its arm, he must climb out on that arm. He is here climbing the Nelson column in London

Keeping Up with the March of Science

Facts for the man who wants to know

Pumping Air into the Brain

THE brain, as you know, is the most delicate part of the human body. Physicians hesitate to tamper with it.

Recently a doctor at Johns Hopkins Hospital discovered a process by which purified air may be pumped into the brain. This makes it possible to locate exactly the position of tumors, and to remove them. A brain tumor usually causes either idiocy or death.

How to Keep Hot Pipes Hot

"WILL an asbestos-covered pipe keep hot longer than an uncovered pipe?"

"Yes," you say. And we answer, "Not necessarily."

Tests have recently been held in the research laboratory of a large electric plant, and these have shown that if asbestos is not applied properly it will tend to dissipate heat rather than conserve it. The layers of asbestos should be put on loosely. Three layers having a thickness of thirteen thousandths of an inch will reduce heat loss considerably.

A New Sugar Tree

THE Douglas fir-tree has a new use—sugar is obtained from it. But, unfortunately, not all Douglas firs are sugar-producing. In fact, there is just one small tract—in British Columbia—where the sugar fir is found.

The masses of white sugar appear on the branches and leaves of the tree. The Indians used to eat this sugar years ago, but it is different from the sugar that we know. Analysis shows that it contains seventy-five per cent melezitose, about three per cent sucrose, and more than eleven per cent reducing sugar.

Italy Is Making Glass Cloth

"AS fine as spun glass," writes the inspired poet. If you wish to know just how fine spun glass is, take note. Felt and cloth are now being made out of it in Italy. Signor Luigi Bisigato is the man responsible for the fabric.

Of course, glass cloth is not used for making clothes—it might scratch. But it is very useful as insulation for storage batteries.

Glass, as you know, is a non-conductor of electricity, and spun glass has the same property.

Prenatal Effect on Canaries

A DOCTOR who has been breeding canaries for several years tells an interesting tale. For months an airplane flew daily over the outdoor cage in which he kept his canaries. Each time the airplane passed the birds would screech and exhibit signs of distress.

During this period twelve eggs were laid, yet only seven of them hatched out. All the seven hatchlings were badly deformed. One baby bird had an extra pair of wings; two other baby birds had twisted legs stretched out full length beneath their bodies.

The same parent birds laid several broods both before and after the airplane flights, and none of these resulted in crippled chicks. It seems clear, therefore, that not only were the parent birds frightened by the airplane, but the scare left its mark on their young.

The Old Wooden Clothespin

EVERY Monday morning thousands of pulley lines squeak and thousands of clothespins are jabbed into place. In spite of many new inventions, people the world over still use the primitive wooden clothespin designed years ago by a New Hampshire man. Twenty million feet of lumber are needed each year to supply the clothespin manufacturers in the United States.

Of the clothespins manufactured annually, two hundred and fifty thousand boxes are exported to England. Many manufacturers have thought that they could use slabs and edgings for making the clothespins, but this is not practicable, since most of them are cross-grained.

Steel that Won't Stain

IF you have ever used a needle you will realize that steel rusts and stains. But now a stainless steel has been invented in the research laboratories of an English munitions factory. It will not tarnish when exposed to the action of different acids.

This steel was discovered while work was being done on armor-piercing projectiles. Its resistance to erosion, together with its high tensile strength, have led to its use in the manufacture of exhaust valves for airplane engines. Since it is not affected by salt water, it is also used for marine purposes.

Making Barrels Out of Paper

WHICH is worse, the paper shortage or the high cost of wood? A barrel manufacturer thought the matter over, finally voted for the wood, and decided to try out a new machine for making paper barrels.

A large roll of paper, six inches wide, is passed through a device that slits it in two and coats one side with glue. The two strips are attached to mandrels that revolve and thereby make the barrel. A flour-barrel can be completed in twenty seconds.

Feeding Garbage to the Pigs

GARBAGE used to be a total loss. It was carted away and dumped in some long-suffering spot. But now garbage is sold to stock feeders and fed to hogs. As you know, pigs will eat practically anything.

The city of St. Paul, Minnesota, received nearly twelve thousand dollars for garbage sold in one year. This took quite a slice off the city's budget.

Surcharge Airplane Engines

DID you know that the higher up an airplane goes, the smaller the amount of power the engine gives out? For instance, at a height of twenty thousand feet an engine's power is only forty-five per cent what it is at sea-level.

But aviators are now using surcharges when they reach high altitudes, and thus are able to keep up the speed they made below. When Major R. W. Schroeder made an altitude record flight of more than thirty-one thousand feet while carrying one passenger, his engine was surcharged.

Fish in a Power Plant

ALGÆ and other water growths persisted in growing in the cooling towers of a large power and light plant. Chemical solutions did not seem to affect them, and finally the company hit on the plan of placing carp in the towers.

Immediately the water began to clear up, and soon all trace of algæ had disappeared. The fish did not interfere with the purpose of the towers, so they still live there.

Guard Against Influenza

FROM hand to mouth—that's how disease is spread. This is the belief of Colonel Cummings and Colonel Lynch of the United States Medical Corps. If people would keep their hands away from their faces there would be less disease.

Take, for example, a case of influenza. The patient asks for a drink of water. He holds the glass to his mouth and drinks; the germs are transferred to the glass. You carry the glass away and the germs are transferred to your hands. Presently you brush your lips with your hand, and, presto! you swallow the germs.

Robbery by Airplane

THIS is not the title of a moving-picture but of a newspaper yarn. Highwaymen held up a bank in Benson, Nebraska, and collected more than a hundred thousand dollars. Two of the robbers were recognized later and arrested. But they were able to prove that they were in St. Paul,

Minnesota, the very afternoon of the robbery. Many people had seen them.

The distance between the two places is so great that only an airplane flying at the rate of at least one hundred and fifty miles an hour could have transplanted the men from one city to the other in so short a time. Detectives are now looking for the airplane.

Is the Toothbrush Harmful?

WHY do we have more trouble with our teeth than our ancestors did? Today there are improved tooth-pastes and toothbrushes—and yet the amount of decay has increased.

The food we eat is generally blamed for it, but now there is a scientist who suggests that the very toothbrushes we use in order to preserve our teeth are causing the decay! He says that the toothbrush is an unnatural instrument, which damages the teeth and is not very effective for cleaning the interstices. He recommends rubbing the gums with the forefinger instead of using brushes.

Platinum Money for Russia?

RUSSIA, we hear, has found a new way out of her financial difficulties—using platinum as a basis for paper money. Russia's normal platinum production before the war was between two hundred and fifty and three hundred ounces a year.

According to a statement from Germany, the Bolshevist Commission of Finances expects to issue sixty-five million rubles in notes of fifty, one hundred, five hundred, and five thousand. A platinum reserve of one hundred and twenty-five thousand ounces will be needed to cover the amount.

Rain, Rain, Blow Away

YOU know how rain on a windshield blinds the driver. Just so, rain, steam, and frost on the motorman's window make it difficult for him to see ahead. One large railway company has decided to equip each motorman's box with air-blowers.

Two air-jets are fastened outside of the window, and are connected with three-eighth-inch pipes. The motorman regulates the flow of air by a valve located near his right hand. The air supply comes from the main air reservoir.

What Pencils Are Made Of

A LEAD-PENCIL is really not a lead-pencil at all—it's a graphite pencil with several other things mixed in. Formerly pure graphite was used, but this became too expensive, and a soft, gritless clay was added to it.

When the ingredients are properly mixed, they are squeezed through a strainer, and the long, thin rods are produced. When dry the rods are placed on a grooved board and smeared with glue. Then another grooved board is slapped on top of it and the two are pressed together. Next they are planed off until the pencils are completely rounded out.

Dandelions for Health

NEXT time you pass a field of dandelions, sit right down and eat some of them. Not only do dandelions make you healthy, but they also keep you young.

Dr. Josiah Oldfield says that a daily diet of dandelion leaves, fowl's eggs, grapes, lettuce, milk, watercress, honey, and salads in general, will do more toward keeping you young than anything else.

Says he: "Old age is caused largely by deposits in the blood-vessels and cells of the body of waste matter." Fresh vegetables help remove this waste matter and form new cells.

Artificial Wool in Germany

SHEEP still grow their coats as long as ever, but that doesn't prevent a wool shortage—particularly in Germany. Therefore it is not surprising that a German has invented a process for making artificial wool.

Wool scraps—shreds, ends, short fibers, washing wastes—that have not been used heretofore are compressed and then soaked in a solution of cellulose and glue. The resulting product is cut into thin strips and made waterproof. This is done by various applications of chromium, formaldehyde, and tannin. Glycerine is used to make it flexible.

Pickling Railway Ties

YOU pickle bones to preserve them, so why not pickle other things—railway ties, for instance?

A Western railroad that has tracks near Salt Lake, Utah, has been storing its ties in a corner of the lake, and the high salt content in the water, acting as a preservative, has greatly lengthened the lives of the ties. They are usually soaked for a year or two, and emerge much healthier for their bath.

This practice was begun when engineers of the company noticed that fir piling lasted indefinitely in the salty water.

Poison Gas Kills Germs

A LARGE quantity of poison gas—which Germany introduced to us as a weapon of war—was left over when the war ended. But now some of it is being used to kill typhus germs.

A small epidemic of this disease broke out among the refugees in Paris. Most of them were wearing second-hand clothes, and the authorities decided to fumigate clothes, mattresses, blankets—even combs and brushes. The germ-laden clothes were hung for twenty minutes in a cylinder containing a mixture of chloropicrin—one of the poison gases used in the war. The epidemic soon died out.

Saccharin—Is It Harmful?

EAT saccharin! That's what you're told every time sugar takes another jump for the worse. But many people believe that saccharin is harmful. The United States Department of Agriculture has been unable to prove it.

In the year 1916 the department started an argument with a large St. Louis chemical concern because it sold saccharin. The case has been brought up in court several times, but a decision has not yet been reached.

Since it is so difficult to prove that saccharin is harmful, you are not likely to suffer much if you try some.

More Pay for Executioners

YOU'RE not the only one who suffers from the high cost of living. The New York State executioner has just asked for a large increase in salary. When he took the job in 1914 he received fifty dollars for an execution. His salary has gradually been raised until now he receives one hundred and fifty dollars for the same work. He has asked that it be raised to two hundred and fifty dollars.

He complains that he has had only one execution in nine months. Has prohibition anything to do with this falling off of his trade?

Troublesome Spiders

A SPIDER in Buenos Aires spun its web near a telephone cable. The wind caught the web and wrapped it around the wires. The web soon became damp and caused several short circuits.

Other spiders in the neighborhood followed the adventurous one's example, and now it has become necessary for the telephone company to send a man out every few days to clear the wires of webs.

Lunching in an Airplane

WHEN passengers first made airplane flights, they said their prayers before they started and shook with fear all the time they were up. Today passengers actually grow hungry and want their luncheon.

That's why several of the airplanes that make regular London-to-Paris trips are equipped with luncheon-baskets. A basket contains six sandwiches, fruit, chocolate, and something to drink. It is sold for seventy-two cents.

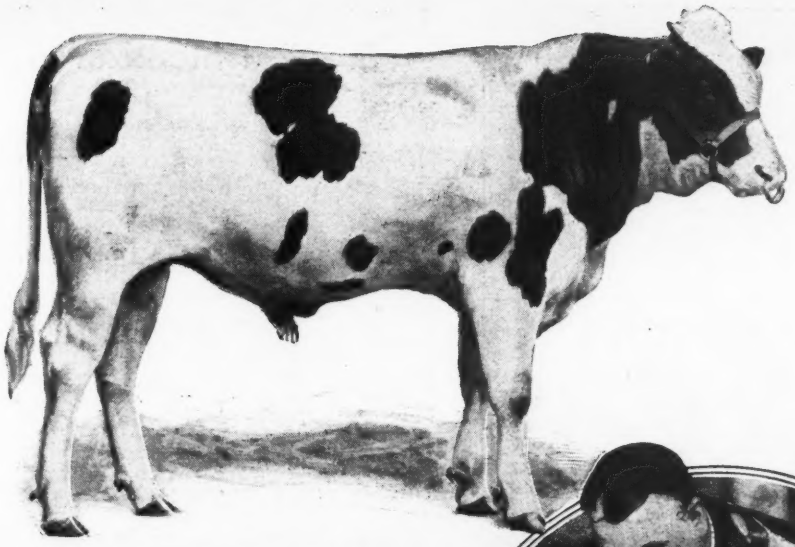
Clean Clothes with Ether

A QUART of ether is much more expensive than a quart of gasoline, yet it is cheaper, in the long run, to use ether for cleaning your clothes. You need only a drop or two of it for erasing the spot, whereas you need a pint of gasoline in order that the same spot may be cleaned properly. Most of the gasoline bought today contains kerosene and is apt to leave a distinct rim around the spot you cleaned.

The only way to clean a garment properly with gasoline is to dip the entire garment in a basin of gasoline; thus it is just as expensive to use a few drops of ether.

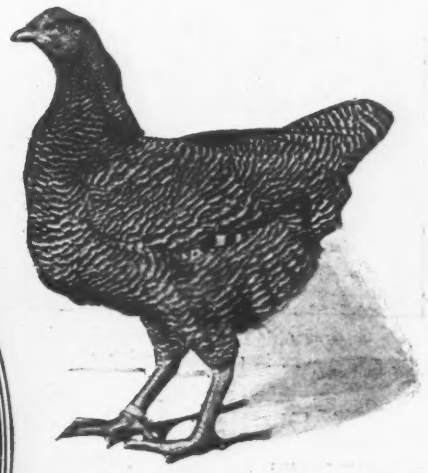
"The time has come," the Walrus said, "to speak of many things," not the least of which is how to make clothes last.

Ten Thousand Dollars for a Hen, Six Thousand for a Rhino—Would You Pay It?



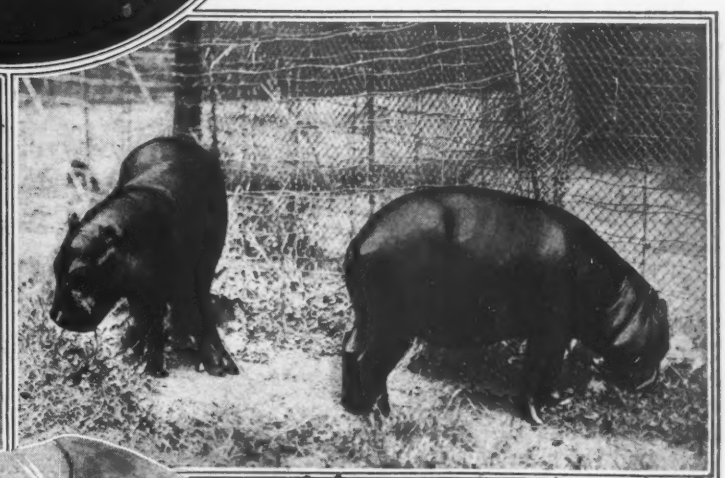
Behold Carnation King Sylvia, the bull of bulls. He's worth more than a hundred thousand dollars. The name "Sylvia" certainly strikes one as not very appropriate, but what's in a name when you're worth a hundred thousand good dollars?

Jasper is signing a three-year vaudeville contract for a thousand dollars a week. No wonder he can afford to wear diamond-studded collars! And Jasper is really clever, as everybody admits who has seen his performance



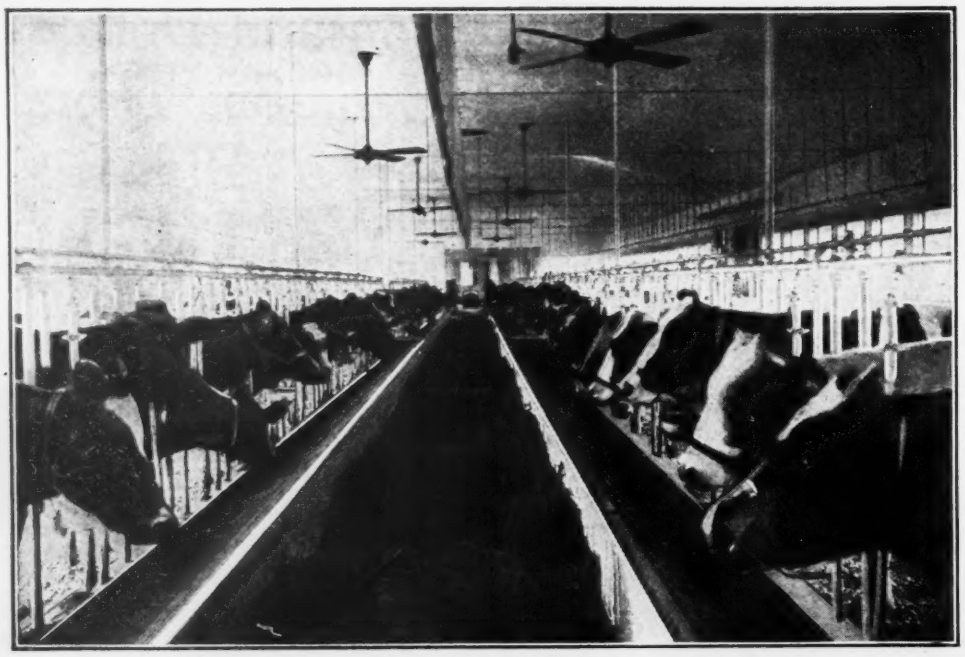
This "Glorious Girl" may not be your idea of a glorious girl, but at least one man considers her very precious. He is Mr. E. B. Thompson, and he paid ten thousand dollars for her

There is nothing very unusual about this cat, but Mayor Hylan of New York thought there was. The cat, employed as rat-killer by the Board of Education, drank six dollars' worth of milk in three months. There was a bill for the milk, also an official inquiry



Next time you call any one a baby hippo, you'll know what you're talking about; these are baby hippos. Like the rhinoceros they are very rare and are consequently very expensive. These two charming pets cost only ten thousand dollars together

This fellow was the first Indian rhinoceros to come to this country in fifteen years. He cost six thousand dollars and is the largest one in captivity



This is not a bovine hospital ward, but a modern barn for dairy cows. It is supplied with electric fans and individual drinking fountains

Cooling the Cows with Electric Fans

DOESN'T it seem a little ultra fashionable for one hundred and eighty cows to drink out of individual fountains while electric fans waft the cool breezes over their aristocratic backs? Mr. Asa D. Candler, Jr., of Atlanta, doesn't think so. He says that his cattle show the results, and he proves it by referring to "Lizze," who since her arrival in the lap of luxury has produced daily forty-four quarts of milk.

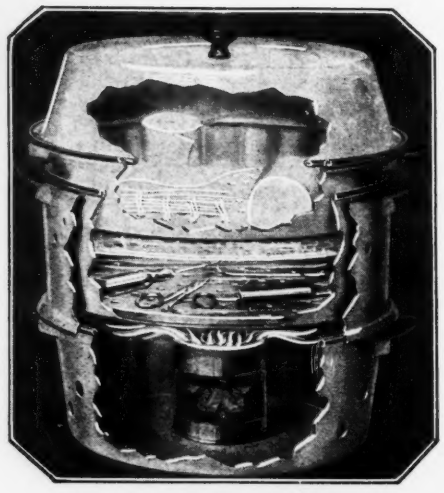
Mr. Candler's barn has concrete floors, wooden blocks, electric lights and fans, steel-frame stalls, individual drinking fountains, milking-machines, concrete feed-troughs, electric silo equipment and milk-bottling machines.

There is always a small amount of water in the bottom of the cement drinking-cup to entice the cow, and when she attempts to drink, she forces the valve open and supplies herself with fresh water.

This Double Boiler Is a Surgical Sterilizer

YOU cut your finger and run to the doctor's. After he has cleaned it, he goes to a white-enameled double boiler on the table and takes off the lid. He puts in his thumb and pulls out—a roll of bandaging! As he winds it around your finger you realize that it is hot.

The white-enameled pot is the new surgical sterilizer. In the bottom compartment there is a can of solidified alcohol. In the upper pots the doctor places his small instruments, bandaging, and such things.



The new sterilizer is like a double boiler. Solidified alcohol is the fuel used. The upper pots hold instruments and dressings

Getting Her Sealskin Ready for Next Winter

EVERY Alaska Indian maid has her sealskin coat. It isn't lined with silk and cut in the latest style, but it keeps her warm during the long winter months. She makes it herself. Here is an Indian maid scraping the inside of a skin to remove the bits of gristle and meat that cling to it. She has stretched the skin on a frame to make it easy to work on.

Indians and Eskimos in Alaska depend almost entirely on sealskin for their clothing, bow-and-arrow bags, and fire bags. Deerskin is sometimes used, but it is not so oily as sealskin, and not so waterproof.

Seals are speared. A native will sit for hours with his spear in his hand, ready to "throw" when a seal comes up for air.

He cuts holes in the ice and drops a bone needle tied to a string into each hole, fastening the other end to a piece of bone stuck in the ice. Then he sits watching. When the seal comes up the string vibrates and he shoots his spear down the hole.

This Alaska Indian maid is scraping the inside of her next winter's sealskin coat

Seaweed and Cotton Make Strong Thread

GINGHAM that used to cost twenty-five cents a yard now costs a dollar a yard. The same thing is true of most cloth. What are you going to do about it?

Japan is bringing down the high cost of cloth by mixing seaweed with cotton. The seaweed used for the purpose is known as *sugamo*. When it is properly treated and mixed with raw cotton it will make a very strong thread that is much cheaper to manufacture than pure cotton.

The outer casing is removed from the seaweed and the fibers within are skinned. These fibers are used in making the thread. Fish-nets woven out of this new material are exceptionally strong, and are not affected by sea-water.

There is said to be an unlimited supply of *sugamo* in Japan today, which is lucky for the Japanese. Perhaps we shall all soon be profiting by this economical discovery.

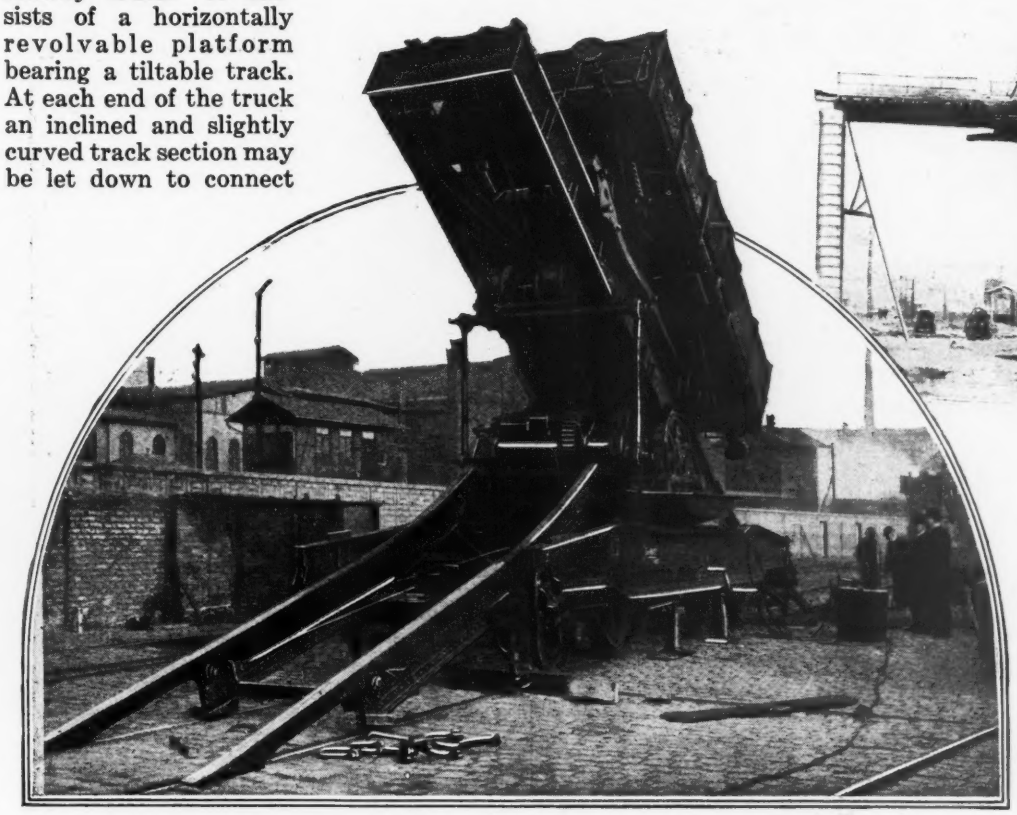
Unloading Thirty Railroad Cars in an Hour

THERE was a time when it required two hours of work by a gang of ten or twelve shovelers to unload a railway car filled with coal, grain, ore, or any other commodity usually transported in bulk. With the aid of highly improved machinery and appliances like those in use at Kiel, Hamburg, and other German seaports at the present time, thirty railway cars can be unloaded in an hour by two or three men.

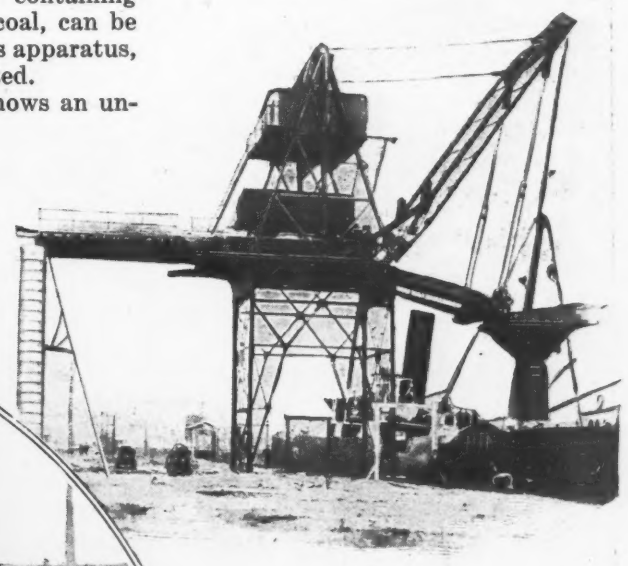
One of the appliances shown in the accompanying illustrations is an unloading apparatus mounted on a large railway truck. It consists of a horizontally revolvable platform bearing a tiltable track. At each end of the truck an inclined and slightly curved track section may be let down to connect the railway track with the tiltable platform. The loaded car is pushed or pulled up the incline, securely fastened and braced to the tiltable track. The revolvable platform is turned to bring the car into the proper position for unloading, the track bearing the loaded car is tilted, the lower end wall of the car is removed, and the material slides out.

Five or six cars, each containing about 120,000 pounds of coal, can be unloaded in an hour by this apparatus, which is electrically operated.

The other illustration shows an unloading crane of unusual construction. The cars to be unloaded are shunted on a trestle bearing a double track. The car is run on a platform and securely fastened. A powerful crane lifts the platform with the car on it, swings it over the hopper suspended above the hatch of the ship to be loaded, and, tilting the car, empties its contents into the hold of the ship.



With this unloading mechanism, which includes a horizontally revolvable platform and is operated by electricity, two men can unload five or six loaded coal-cars an hour



Thirty loaded coal-cars can be emptied into the hold of a ship in an hour by the aid of this modern unloading crane, which lifts the platform with the car on it

How They Carry Wine in Portugal

WE do the ox no injustice when we call him stupid. Take, for example, the oxen shown below. They drag behind them a barrel of good port wine, yet they aren't even interested. That barrel might just as well contain kerosene!

However, the picture was taken in Portugal, where port is plentiful and not in disgrace.

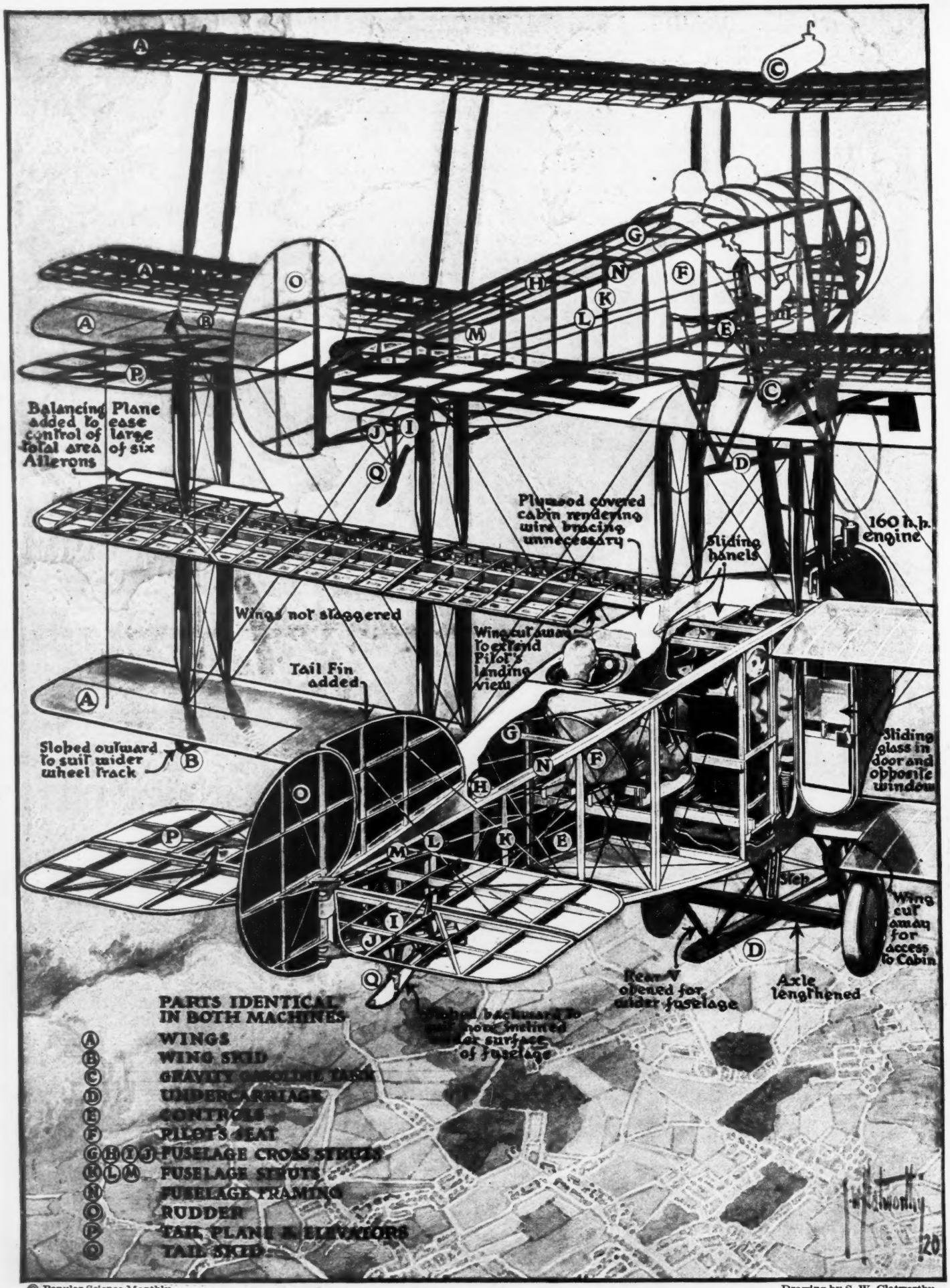
The chief center of the port wine industry is Oporto, a city in the Douro district. Since the beginning of the eighteenth century the wine of this district has been exported in large quantities.

The vines are grown on the mountain slopes. At the beginning of October grape-gatherers start cutting off the bunches of grapes. Great care is taken to see that no bruised grapes are left with the good ones. After the juice is squeezed from the grapes, it is allowed to ferment until the right degree of sweetness is obtained. Then it is drawn off into vats, and wine brandy is added to stop fermentation.

These Portuguese oxen don't realize how lucky they are. Right behind them is a barrel full of excellent port wine

The ancient city of Oporto is one of the most beautiful cities in Europe, the architecture being strongly Oriental. It is situated on the Douro river, which is subject in winter to sudden and violent floods. In summer, however, there is boat-racing between local clubs and those from Lisbon—English residents having introduced this sport, as well as lawn tennis and cricket.

The wine is manufactured and stored principally in picturesque red-tiled lodges.


Balancing Plane added to ease control of large total area of six Ailerons
Plywood covered cabin rendering wire bracing unnecessary
160 h.p. engine
Sliding panels
Wings not staggered
Wing cut away to extend Pilot's landing view
Tail Fin added
Sloped outward to suit wider wheel track
Sliding glass in door and opposite window
Step
Wing cut away for access to Cabin
Rear V opened for wider fuselage
Axle lengthened
PARTS IDENTICAL IN BOTH MACHINES
A WINGS
B WING SKID
C GRAVITY GASOLINE TANK
D UNDERCARRIAGE
E CONTROLS
F PILOT'S SEAT
G H I J FUSELAGE CROSS STRUTS
K L M FUSELAGE STRUTS
N FUSELAGE FRAMING
O RUDDER
P TAIL PLANE & ELEVATORS
Q TAIL SKID

© Popular Science Monthly

Drawing by S. W. Clatworthy

Making Over War Airplanes for Peace-Time Uses

CONSTRUCTED of old biplane parts, the triplane Avro 547-K, here pictured, carries four passengers and has a speed of ninety-four miles an hour. This shows what Great Britain can do in salvaging parts of old airplanes.

A syndicate has been organized in Great Britain, headed by F. Handley Page, which is frankly out for foreign business. In one week it is said to have exported fifty-seven airplanes to the United States. There are rumors of ten thousand machines to be sent to this country.

It is the opinion of Major-General Charles Menoher, director of the Army Air Service, that this influx of foreign airplanes into the United States may jeopardize the American airplane industry. Yet if the old machines are made over as successfully as was the Avro 547-K, what is to become of the American airplane industry?

The Lincoln Highway—Our Wonder Road

The ocean-to-ocean highway is no longer an unrealized dream

By Fred Gilman Jopp

SEVEN years ago the idea of a transcontinental highway connecting New York with San Francisco, improved throughout its length and forming a backbone for a great national system of arterial roads, was only a dream in the minds of a few. To-day the accomplishment of this great memorial route stretching from ocean to ocean is assured.

The Lincoln Highway breathes the twentieth century. In years to come it will be adorned, as were the Roman roads, with statuary, landmarks, homes, hotels—a panorama of the achievements of man. It will be the path of advancement, a golden chain linking the Atlantic to the Pacific.

The motor-truck is in its infancy and highway freight-transportation as an adjunct to the railroad is only just beginning. But the Lincoln Highway Association feels that it is well within its province to act as a clearing-house for the best thought in the United States concerning the probable requirements of main arterial American highways in the next twenty years.

What will be the specifications for this wonder road? That has not yet been decided. The association realizes that it is undertaking a difficult problem, but it believes that it will have, in solving it, not only the interest and support of the American public, but the co-operation of the engineers and highway commissioners, and also the best technical experts the country affords.

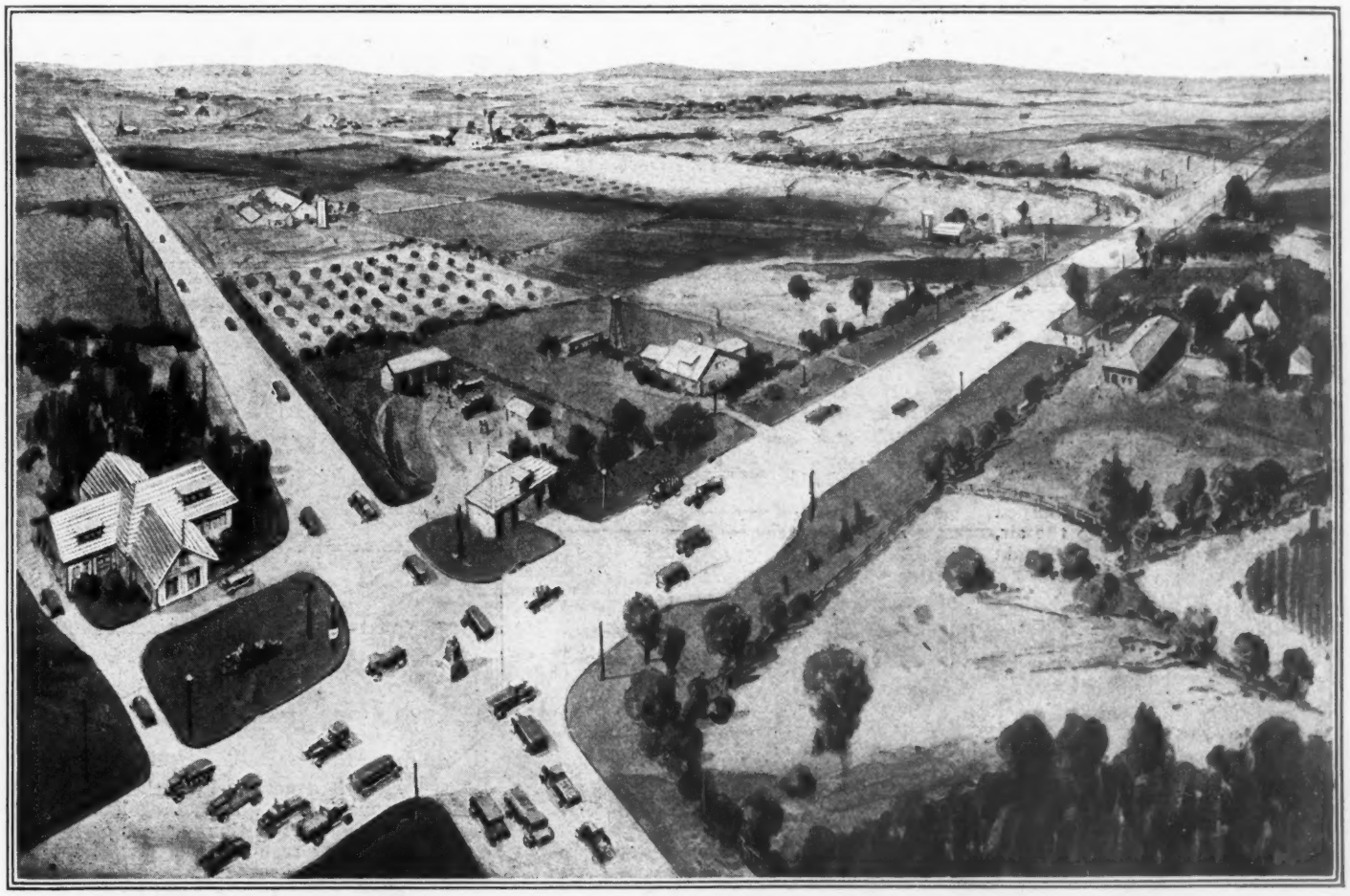
Some of the finest concrete roads of the country are to be found in Michigan. These have a standard thickness at the sides of six and a half inches. About the best stretch of highway we have at present is the Lincoln Highway from New York to Philadelphia. It is ninety-six miles long, and every day there passes over it an average of two thousand tons. This road is eight inches deep at the sides and ten and a half inches at its center. This is the thickest surfacing in the United States to-day.

Whether the show road of the world will be of this thickness or deeper is under consideration. There is some thought of making it ten and a half inches at the sides and twelve inches at the middle, for it must be permanent. If the added advantage of this thickness overbalances the additional cost of construction, then the plans will call for this depth. It may be made even thicker than this. No one knows until the engineers have expressed their plans. The width must also be carefully thought out.

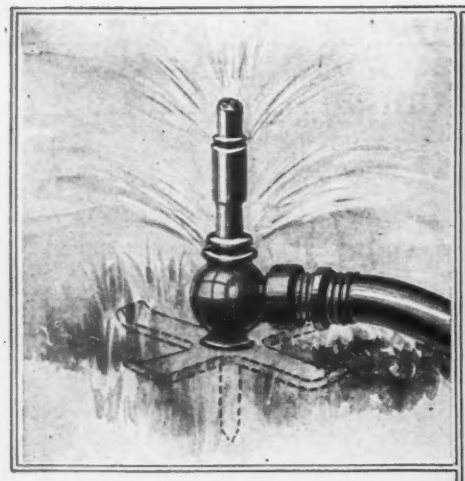
The association's plans do not stop with the construction of the road itself.

It has long been apparent that ultimately there must develop along America's main routes of heavy passenger and freight transportation, a new and distinctive type of accommodations catering particularly to such traffic and situated perhaps in the open country. Such accommodations, removed from the traffic and noise and necessarily higher prices of the congested centers, would provide for the tired and dusty tourists, or the drivers of freight-transport vehicles, convenient night stops where every effort would be made to cater to this particular type of patronage.

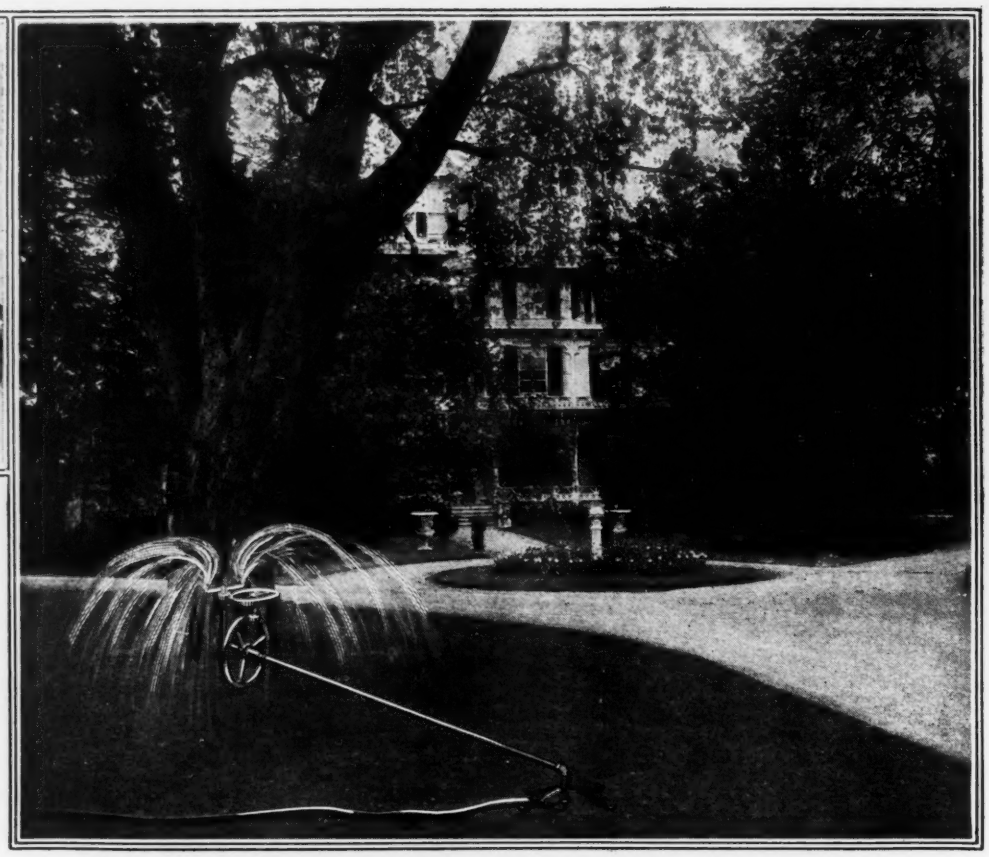
In conjunction with such accommodations arrangements would be provided for those tourists or travelers desiring to camp out. Free campsites are even now being provided.



The right of way will be parked and beautified for some distance from the fence line. This construction shows the paving as wide enough for four lines of traffic with no barrier between the east and west bound

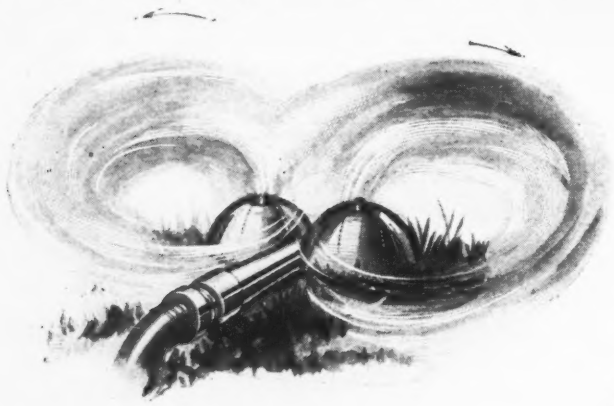


A "double-decker" lawn sprinkler. Fine holes through which the water is forced split the stream into a "spray" of very realistic artificial raindrops simulating the soft rain of spring



This sprinkler automatically travels uphill and down until it has made the rounds of the big, old-fashioned lawn, leaving not a single inch of turf unsprinkled

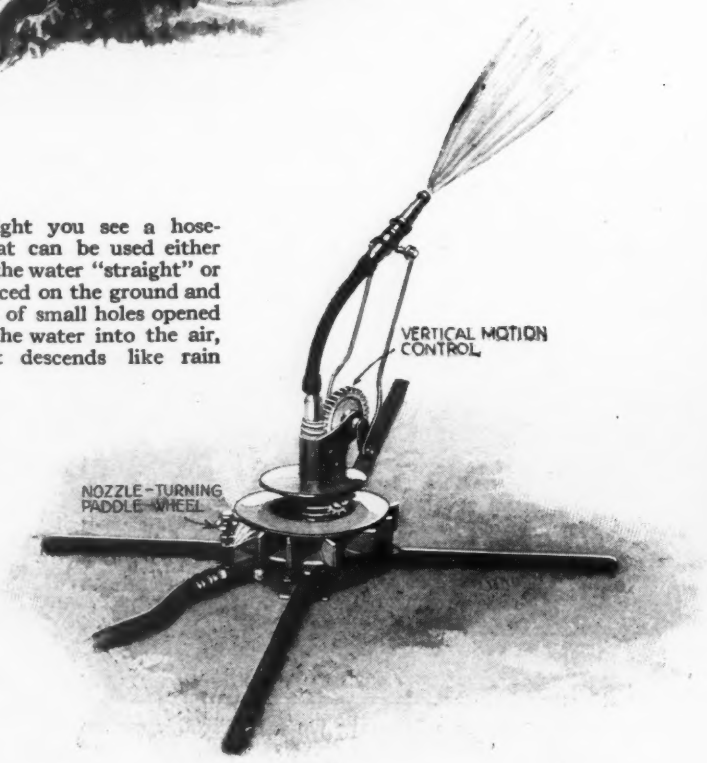
In the unusual nozzle shown below two streams whirling in opposite directions are brought together, the water is atomized and the fine spray is thrown out over the grass or the flower-bed

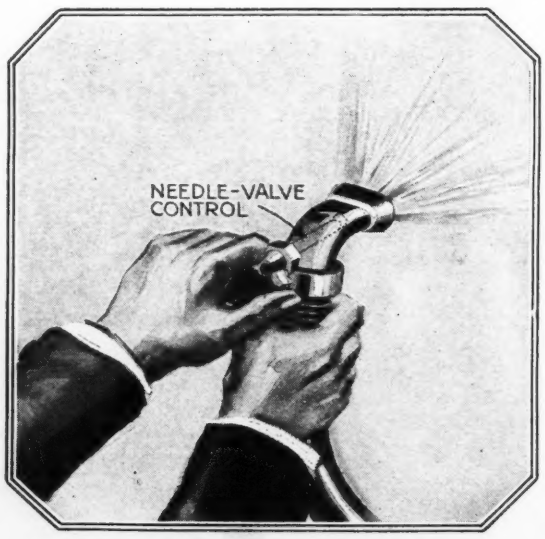


Many and Various Are the

The makers have spared making devices to satisfy the

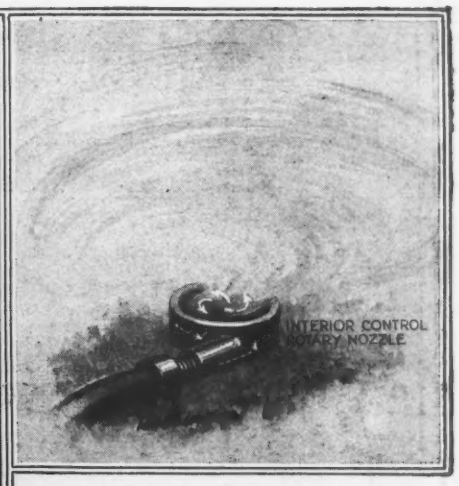
At the right you see a hose-nozzle that can be used either to throw the water "straight" or can be placed on the ground and the spray of small holes opened to throw the water into the air, whence it descends like rain





Here is a garden hose that is convenient to hold and regulate by hand. The thumb-screw at the back regulates the size of the drops in the spray by a slight twist of the hand on it

Here is a metal barge to move the sprinkler around the lawn without cutting off the water. It sends out a plentiful spray in every direction

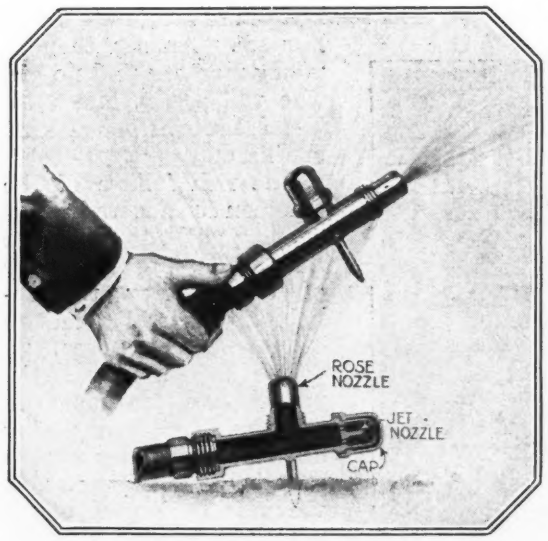


Centrifugal force, created by the curved channel through which the stream of water must flow, sends the water out of this nozzle in the form of whirling drops of spray resembling a mist

Sprinklers to Keep Your Lawn Green

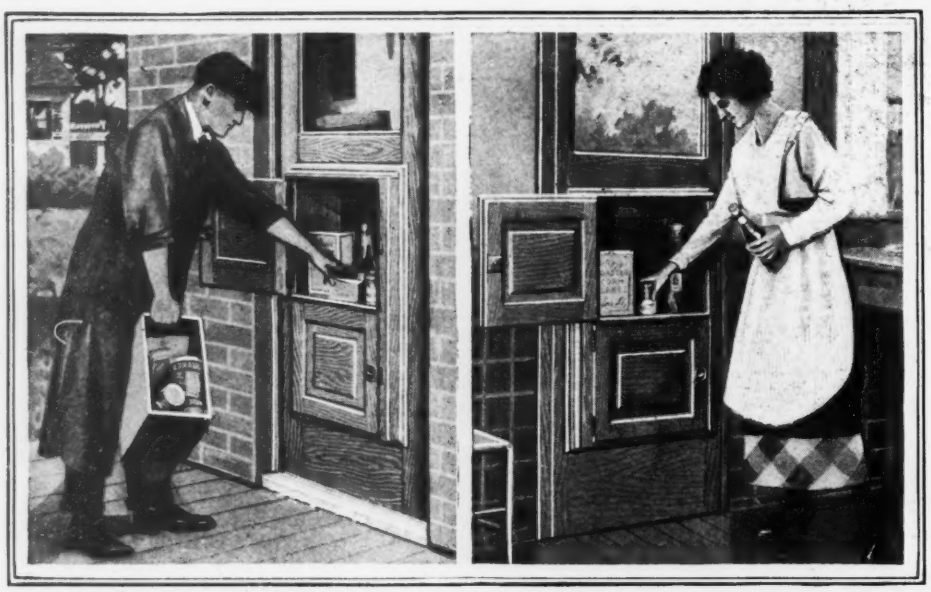
no pains in planning rain-thirst of every variety of grass

The sprinkler pictured at the left is a most extraordinary type of sprinkler. Notice the curved pipe. This pipe is perforated with fine holes so arranged that the force of the water twirls the pipe around, sending the spray into the air in a graceful swirl



The pressure of the water works a device which rotates the nozzle of the hose automatically, throwing a spray of artificial raindrops over the lawn to an area of about one hundred feet

The sprinkler below throws water in a rectangular shape. A square-headed nozzle contains passages through which the water is forced, forming a fine veil of spray



The grocer deposits his goods in a small compartment in the door and the compartment locks automatically

As the outside door of the compartment locks, the inside one unlocks. In passing you remove your groceries

The Door Receives Your Packages

EVERY time Mrs. Jones goes upstairs the door-bell rings. First thing, it's the grocer; then it's the butcher. She has to stop working, go downstairs and open the door to take them in. But now there is a new kind of door that will receive packages by itself. It has two good-sized compartments in its lower half that open from the inside and from the outside. When the grocer comes with his cornflakes and soup, he opens the door of one of the compartments and deposits his groceries within. As he closes the door it locks automatically, a "taken" sign bobs up, and the inside door unlocks. It is a very simple matter for the housekeeper to take the packages off the shelf when she happens to pass by.

Two compartments are usually enough for the average family's needs, but more can be supplied.

A Landing-Light for the Use of Airmen

A PAIR of headlights will guide a motorist at night, but they won't suffice the airman. He has to deal with a third dimension. That's why powerful searchlights are essential at landing-fields.

A portable oxyacetylene landing-light, made in London, is shown here. It is mounted on regular airplane wheels and can be pulled around the field to suit the wind changes. The high mounting of the axle enables the light to be pulled over rough ground.

The searchlight is mounted on a fixed tripod on which it is able to revolve freely. The projector body in which the light is located has a parabolic mirror in the rear and dispersing mirrors in front. There are also two pairs of cylinders, containing acetylene and oxygen. Armored hose-pipes lead from both and terminate in a mixing chamber, where the gases are mixed in the proper proportions. They pass up the burner pillar to the jet.

This oxyacetylene landing-light for guiding night flyers is complete in itself and can be pulled around the landing-field with ease

Head-Hunting in the Solomon Islands

STEALTHILY creeping among the luxuriant undergrowth of the tropics, the cannibal of the South Sea Islands collects the heads of his enemies. He spends weeks smoking the relic until it is sufficiently dry to be decorated with paint. His effort is to make the head as "lifelike" as possible, and when he has succeeded, and the head adorns a conspicuous place in his abode, along comes the daring civilized white collector of souvenirs, and soon this same head ornaments the case of a museum in some distant city, horrifying the less bloodthirsty inhabitants of the temperate zone.

Brooding in the shade of the sandalwood and ebony forests are these strange descendants of pure Papuan stock, tall and sturdy, with projecting brows, deep-set eyes, restive and shifting as those of wild beasts, and thick woolly hair. In color their skin ranges from copper hue to dark brown, merging the native artfully into the shadows of the bushes in which he hides.

Smoked and painted heads brought from the South Sea Islands. Numbers 1, 3, and 4 are from the Solomon Islands. Heads 7 and 9 are from the Punans, an aboriginal tribe of Borneo, and were captured by head-hunting Dyaks, afterward being retaken by a British punitive expedition. Wooden forks (5) and a meat-hook (8) are shown. Figures 6 are the dinner-plates, also of wood

The sea Dyaks are inveterate head-hunters. Among them a young man can find no girl who will accept him until he has brought her at least one head.

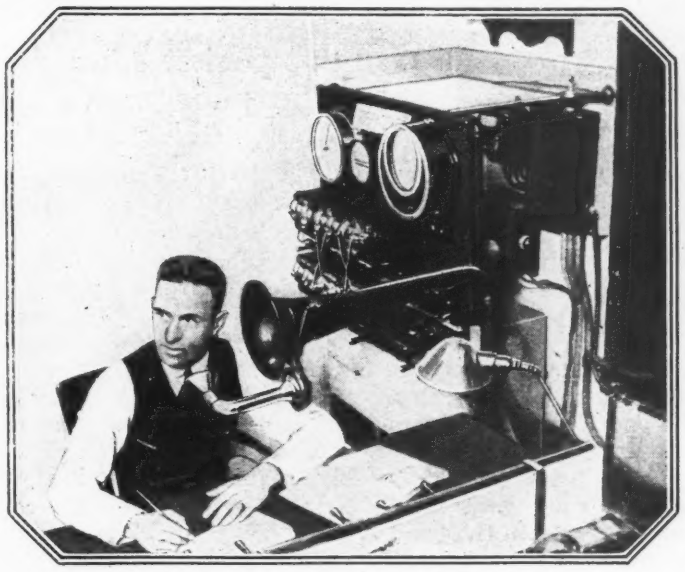
The rich foliage of the Solomon Islands invites the cruising yacht to rest there for a while, but the danger of encountering the inhabitants is still a matter of present-day concern.

The evidence that the natives are particular in their manner of disposing of their enemies by way of cannibalistic methods is shown in the nature of the utensils used in their savage feasts. Curious forks and knives of wood were us d because the custom of the islands forbade the use of metal in handling the cooked flesh of human beings.

Magnifying the Voice for the Train Despatcher

DID you ever get a loud "jolt" when listening at a telephone receiver? The operators and despatchers in power plants, where heavy charges of electricity may provoke induced currents in the private telephone systems of such companies, now have a way to protect themselves from injury. The shock to the ear-drum caused by a short circuit or other disturbance on the power lines can be prevented by using a megaphone instead of the ordinary receiver.

The specially adapted receiver is a great improvement over the ordinary apparatus with which we are familiar. On quiet lines the kind of telephone receiver one finds at home can be used satisfactorily. But in great power plants, where the lines are very noisy, and where important business must be transacted, the use of the high-power system employing the megaphone is a relief. It is possible to talk over noisy lines, and voices can be more distinctly heard over greater distances on comparatively quiet lines. The energy for a private telephone of this kind is furnished by a storage battery of the automobile type, charged occasionally by a small rectifier of the Tungar type.



The despatcher seated at his desk in a power plant. He uses a megaphone equipped with a high-power circuit supplied from an automobile-type storage battery. The voice is thus projected into the room naturally

The private telephone in a plant where heavy loads of current are switched is subject to induced interferences. This produces that loud rattling or rapping sound so very unpleasant to a listener who is trying to catch the faint sounds of the voice at the other end of the line.

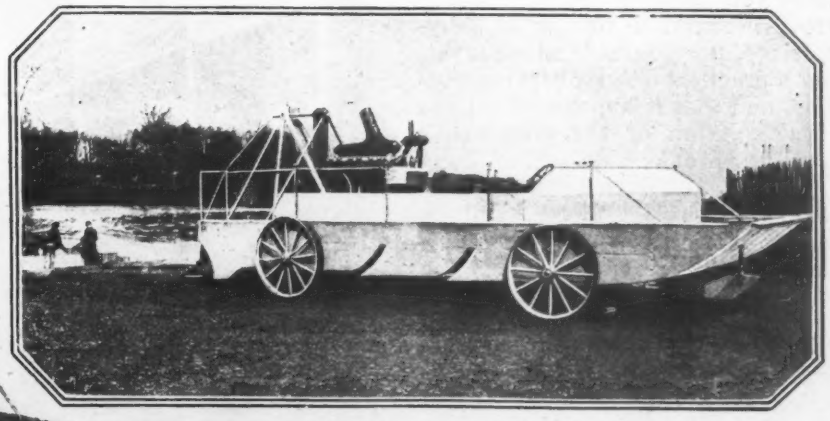
The Latest Model in French Hydroplanes

EVER since the days when the little old ricochet hydroplanes startled the world by the phenomenal speeds they attained on the Seine, the French have been staunch believers in the hydroplane idea, and until the outbreak of the war had developed this type of craft to a very high degree, as shown by the records made at the annual Monaco regattas. Since the war the French designers have turned their attention once more to gliding craft, and, in preparation for the Monaco meet, they built several boats which, according to press reports, attained speeds upward of seventy miles an hour for short spurts on the quiet waters of the Seine.

One boat, built by Depujols and powered with a British Sunbeam motor, was said actually to have exceeded seventy miles an hour; and the boat shown below, which is driven by a Renault aviation motor and air propeller, also is said to have made extremely high speed. From its design this is difficult to understand. It will be noticed from the photographs that the hull is a rectangular scow, the bottom of which is divided into several planes set at a slight angle of incidence, but without the lateral angle or V shape that is characteristic of the well known Fauber type of hydroplane.

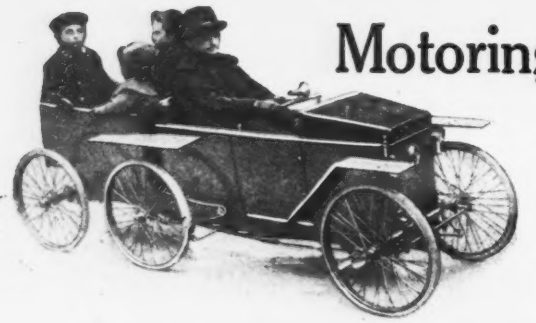
It will be noticed also that a space has been left between the planes which undoubtedly is to permit the entrance of air behind the space to relieve any tendency to a vacuum and consequent eddy. The designer may also have figured that, by thus admitting air behind the space, the friction of the water on the bottom would be cut down to some extent by its mixture with air.

There is no doubt that this type of hull has possibilities for speed in perfectly calm water, where conditions will permit the hull to rise out and run on the tips of its planes; but in choppy water it is obvious that the skin friction of the water on such a large surface would be detrimental to speed; and, while the boats may have attained the speeds claimed for them for short distances on the river, it is almost certain that these speeds will not be possible in open water.



The hydroplane type of boat is wheeled down to the water—the wheels fitting in two of the grooves in the bottom. These grooves relieve any tendency to a vacuum and consequent eddy. They may also cut down the friction of the water by admitting air under the boat

Strange as it may seem, this boat can attain a speed of seventy miles an hour. Its queer square shape enables it to skim swiftly over smooth water, but makes it travel slowly over rough. It will enter the annual races at Monaco this year



The flivverette is not limited to two passengers. It will seat three children in a trailer

Motoring May Be Cheaper than Trolleying

Will this pocket edition electric automobile solve the poor man's motoring problem?

By Fred Gilman Jopp

YOU have, no doubt, pictured in your mind your idea of the poor man's automobile. While every one will not agree as to what constitutes the most desirable car, due largely perhaps, to the difference in individual automobile requirements, nevertheless in the essential elements there is little diversity of opinion.

Dr. R. Slaby, the eminent radio inventor, of Germany, whose name is known to every wireless amateur throughout the world, and Mr. H. Beringer have jointly invented and built a miniature electric automobile. It embodies no new principles, but its design is simple, compact, and worthy of wide attention.

The smallest electric car in the world seems to solve the problem of the automobile for the man of moderate means.

The New Flivverette

Readers, meet Dr. Slaby's flivverette, which was invented to carry you for less money than even the trolley, and which is small enough to be parked in your back yard or upon the porch. Note its narrow-gage wheels and diminutive body, which will permit it being garaged in almost any waste space.

On closer inspection of the pictures you discover that it is not a cross between a toy and baby-carriage, as you at first thought, but a practical means of transportation, and that it appears to be the ideal solution of the poor man's motoring problem.

Since it is driven by a twenty-four-volt electric motor, and its motive power is derived from a fourteen-cell storage battery, the operating expense is immaterial—below that of the usual trolley fare. Two and a half kilowatt hours are required for charging the battery, which at a cost of twelve cents gives the car a travel range of approximately twenty-seven or twenty-eight miles.

One of the striking features of the car is its extreme lightness of construction, the car being only four hundred and fifty pounds in weight. This is due to the compact design and the application of airplane principles of construction.

The little car travels with truly astounding ease and smoothness. This is probably due to its extreme light weight and the ball-bearings in the wheel-hubs. A single person can be comfortably seated in the car with his legs stretched out beneath the hood.

Position of the Motor

There is no leg interference; the motor is set beneath the driver's seat, where it is easily accessible for adjustments or lubrication. This electric twenty-four-volt motor is of special design, insuring a marked improvement over other models, and enabling the car to get away from a standing start with surprising quickness.

The motor is fed by a fourteen-cell accumulator battery charged to a maximum of thirty-three volts and from twelve to fifteen amperes. There are two speeds, controlled by a lever similar to that of the average electric automobile, which enables the car to travel at from ten to twenty-five miles an hour.

The braking system comprises three brakes: a foot-brake, which for the convenience of crippled war veterans can be converted into a hand-brake; an electric brake for emergency cases; and a brake acting immediately upon the rear wheels. The wheels are about the size of those upon a child's tricycle, and they are fitted with either solid or pneumatic tires.

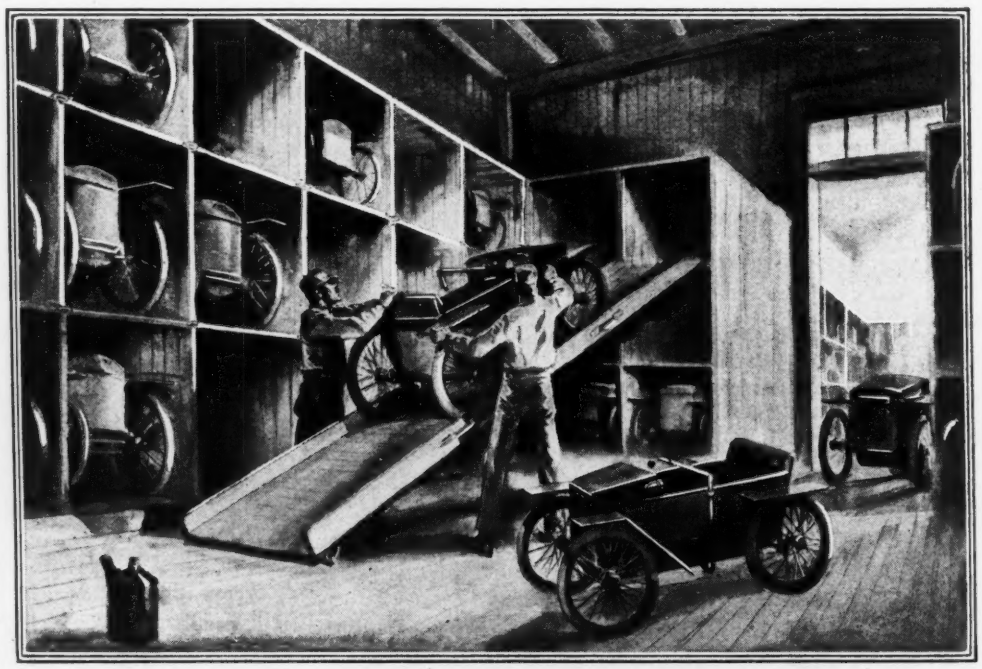
The steering gear comprises a steering lever and handle, operated in about the same manner as that of a motorcycle. This lever can be lifted clear of the car body when the driver wishes to enter or leave the car. As in the modern electric, a special catch keeps the steering handle in a horizontal position when the car is left standing at the curb.

Transmission of the steering gear to the front wheels is effected by means of a thrust-and-tension rod, resting at both ends in hardened ball-bearings. The rear wheels are driven by a substantial roller chain from an intermediate shaft.

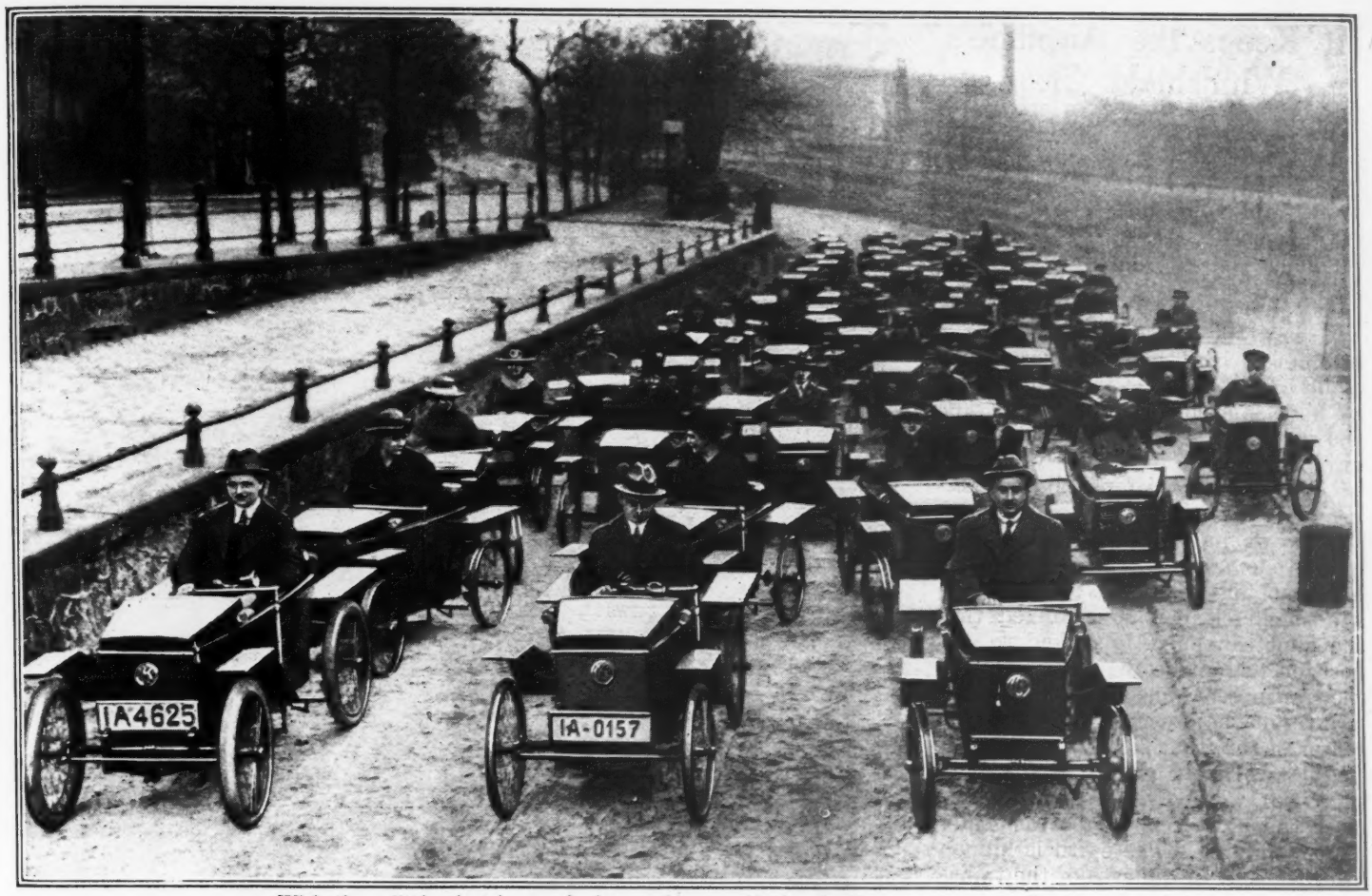
How the Shaft Is Mounted

This shaft is mounted by means of ball-bearings with a bulbous adjusting ring in aluminum bearing-blocks, which are readily shifted to the lower frame of the car's chassis, thus allowing the drive chain to be tightened whenever it is necessary with a minimum amount of effort.

A special set-screw at the bearing-



And here is the flivverette garage. A platform placed at a certain stall enables two men to push the little car into its berth, where it rests comfortably and out of the way



With these little electrics anybody can have an outing in the country on a Sunday. These are only a few of the machines that are in actual operation in Europe

blocks serves for the finer adjustments. This is similar to the adjustments used for tightening the sprocket chain of a bicycle.

The intermediate shaft is operated by means of a roller chain from the electric motor situated beneath the driver's seat.

The motor insures a remarkable high starting torque with a very low current of consumption. The driving gear is locked by a safety key, which prevents the car from being stolen when it is left standing in the street.

By attaching a small trailer that accompanies the car another passenger may be carried, or even three children; or the trailer may be used as a baggage compartment.

Different from a Gasoline Car

How different is this tiny electric from the gasoline car! All the complicated and annoying repairs arising from such parts as fouled sparkplugs, wrong carburetor adjustments, ignition troubles, and so on, are eliminated; for with a minimum amount of care the car can be kept free of mechanical difficulties.

Dr. Slaby's invention has made it possible for people of small means to get away from the clatter and stuffy odors of the city—out into the refreshing country so necessary to the man of sedentary indoor tasks.

When a man's business necessitates his getting about town quickly, he finds the flivverette the ideal car for the purpose. Its narrow gage and its flexibility enable him to wend his way in and out of traffic quickly and easily without fear of collision; for the car is so small that he may venture in where larger cars would fear to go.

When he is through with the day's work he parks his flivverette in what we might term a dog-house, which he has made expressly for the purpose.

The nearest American equivalent of the German flivverette is this gasoline cycle-car, here displayed to show our idea of a small, cheap car

A special electric charging station can also be bought for this car at a nominal sum. It is operated from the lighting current in his home. Why should he worry about the high cost of gasoline?

Cost of Electricity and Gasoline

Contrast electricity with the cost of gasoline today. You pay as much for one gallon as you did for two before the war, and its quality is inferior despite its high price. Electricity, on the other hand, is plentiful, it is all the same quality, and you are certain of getting what you buy. This is the reason why electric cars have increased eight hundred per cent in England since the beginning of the world war.

Serious competition between this tiny electric automobile and the motorcycle is now an established fact. In the design of the flivverette reduction in weight has been a prominent factor. A good appearance, too, has been aimed at and attained; in fact, the little vehicle comes very close to resembling the full grown electric automobile.

Almost anybody can own one of these cars. It is possible to ride a long way for a few cents, garaging the little car in some vacant corner.

It Keeps the Airplane's Windshield Clear

WHEN a great cumulus cloud piles upward or rolls serenely along over the landscape, one can picture the conditions encountered in such a cloud. The aviator has an opportunity to experience some of the weather afforded in the cloud itself.

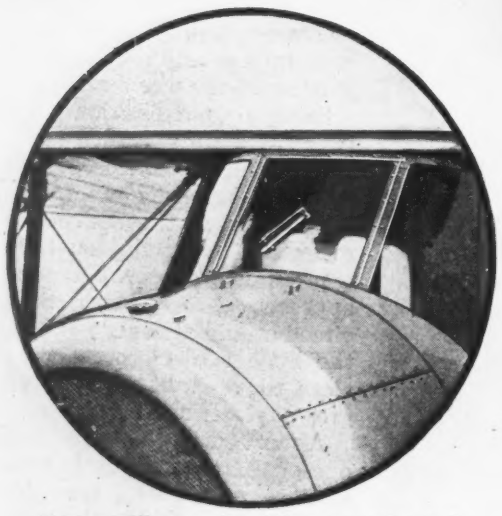
It is not always his desire to do so, and as a rule he will avoid such an encounter; but when he flies into a cloud where a storm is taking place, he finds himself in the midst of rain, snow, or sleet. The windshield of the airplane may become thickly covered with the moisture, completely obstructing the view.

Now we have an invention calculated to overcome this objectionable feature of air travel. It is an automatic windshield cleaner, so arranged that the pilot can move it around to any position to remove the moisture from the transparent shield. To accomplish this result the device is placed in the center of the front screen.

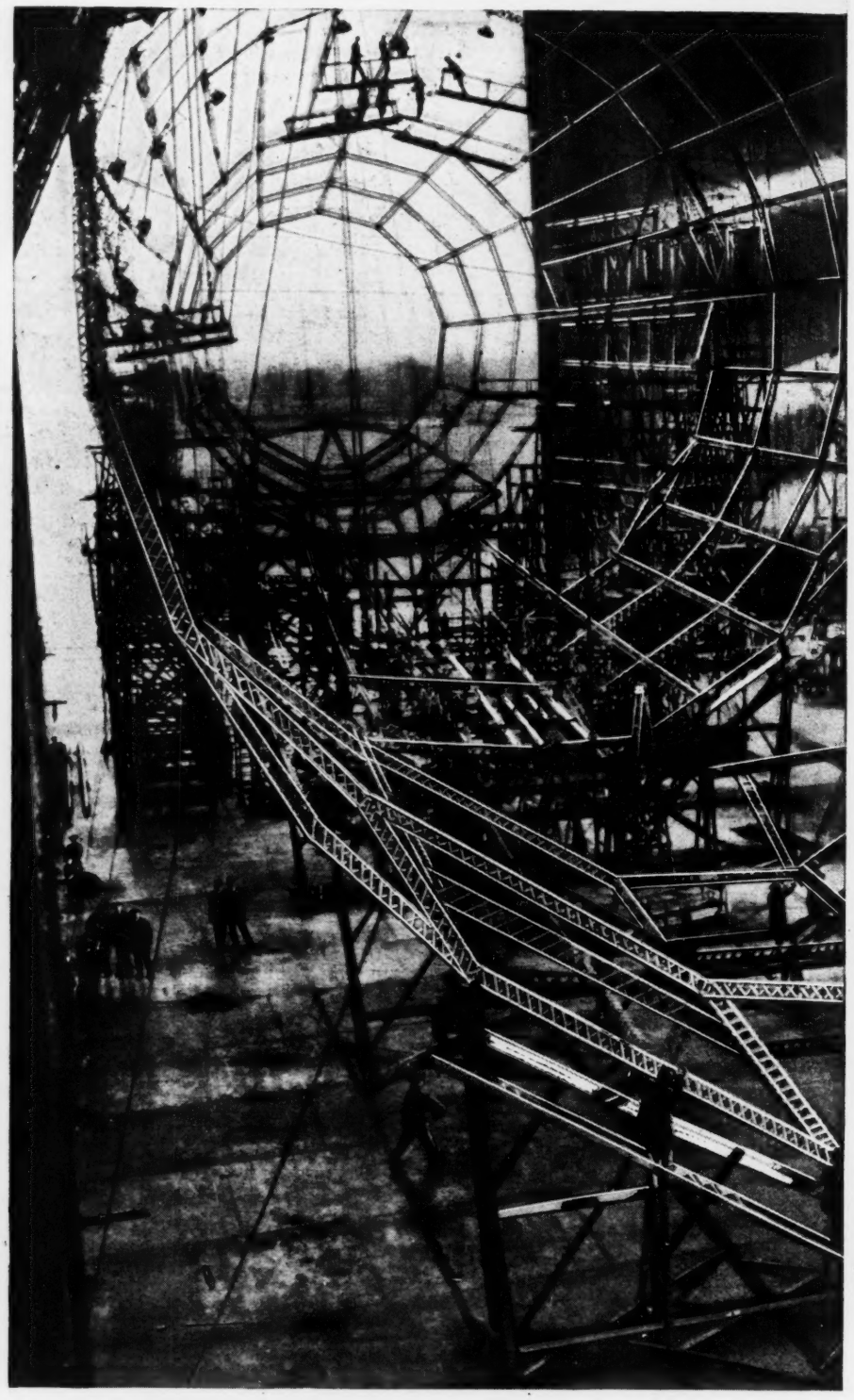
Aviators avoid clouds at low altitude, but while flying very high the most violent storms may occasionally be encountered. The earth is hidden from view, as in the case of the transatlantic fliers, and the horizon is lost. Then the airplane may be upside down a part of the time, the pilot sense of stability being for the time deceived.

With the collection of moisture on the windshield, he is deprived of the momentary glimpses afforded by openings in the cloud. The value of the windshield cleaner is more readily appreciated when a landing must be made in the rain. Then, if ever, it is imperative that a clear view of the ground be afforded.

The instrument indicating the altitude cannot be relied upon to make a safe landing. The pilot must judge his distance from the ground before he permits the wheels of the machine to touch the surface.



Airmen will appreciate this automatic windshield cleaner, especially when running through moisture or when making a landing

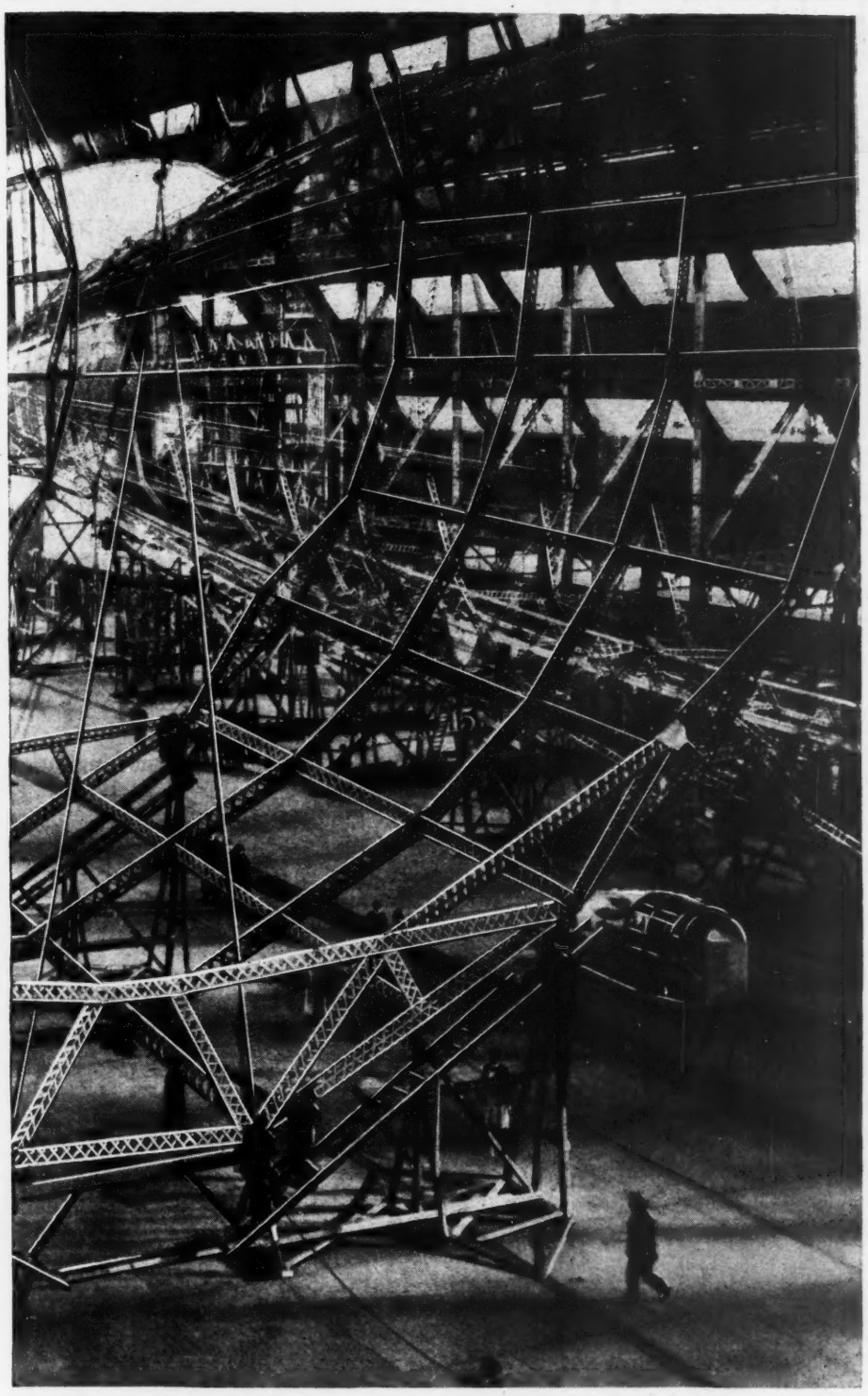


The R-38, constructed for the United States by an English firm at Bedford, $2,700,000; it will hold nearly 3,000,000 cubic feet of helium, and reach a length

Our Big Dirigible, the R-38,

A LARGE dirigible, the R-38, is now being constructed for the United States by a company at Bedford, England. Within a short time this mighty ship of the air will point its nose toward America and start its trip of more than three thousand miles across the Atlantic ocean. An American crew to man this great airship is now being trained for the purpose. The huge skeleton of the R-38 is pictured here. Officials of the United States government are going over it and examining it minutely.

Although the frame of a great dirigible looks like a bulky mass which would have considerable weight, it is one of the lightest of mechanical structures. The strength of the framework depends upon the structural combination of comparatively frail material, each part of which is, in itself, weak. Expert workmanship and a high degree of skill are demanded of the builders of such aircraft. When



England. It is one of the largest dirigibles ever constructed. Its price will be of 994 feet. Its maintenance will cost the United States $600,000 per annum

Built to Cross the Atlantic

the R-38 is finished, the United States will own one of the largest dirigibles ever constructed. It will cost $2,700,000, and will contain nearly 3,000,000 cubic feet of helium. Its length will be 994 feet.

Such a ship will cost $600,000 a year to maintain. It will carry a battery of small guns and a special cannon, now being developed.

While craft lighter than air cannot attain the speed of heavier-than-air machines, they have the advantage in lifting power, and generally are safer. The fact that the framework was made of metal has largely been responsible for static discharges due to electrification of the metal, the discharge taking place as the great ship touched ground. With hydrogen as an inflating medium an explosion invariably followed. Aluminum frames can be used with the non-exploding helium.

The *Wasp* Is the Speediest Hydroplane

GLENN CURTISS, the man who began his early experiments in aviation over one of the small lakes of New York state, has brought out a type of hydroplane which has established a new world's record for speed.

This hydroplane can travel at the rate of 138 miles an hour, as was demonstrated on a trial trip piloted by the celebrated flier, Roland Rohlfs, the Curtiss test pilot. Rohlfs also established new records in altitude and climbing tests at Roosevelt Field a year ago in this machine.

The new hydroplane is equipped with three planes, and has suitable pontoons for landing and taking off on water. It is now the property of the United States Navy, and will be used at Hampton Roads, Virginia, for purposes of training young aviators.

The previous world's record for speed was 126 miles an hour with a hydroplane, and this was also held by a Curtiss machine, the Curtiss HA hydroplane. The present triplane is equipped with a Curtiss 400-horsepower engine of twelve cylinders. The easy control, and the manner in which this wasp of the air can dart here and there, has perhaps suggested its name. It is called the *Wasp*.

Wealthy people who live near a body of water are taking up the hobby of aviation, and to this the hydroplane seems to be specially adapted. It can fly over land, but when it comes down it requires a suitable stream of sufficient width and depth. Along the shores of a lake or the length of the coastline, there are plenty of fine places for the "fish of the air" to make a safe return to water.

It is an attractive sight to witness one of these "flying fish" skimming the surface of a lake, or following a stream. In the hydroplane one realizes the achievement of great speed. Over the tall masts of yachts dotting a harbor the flying boat streaks by, fanning the air into a hurricane with its propellers.

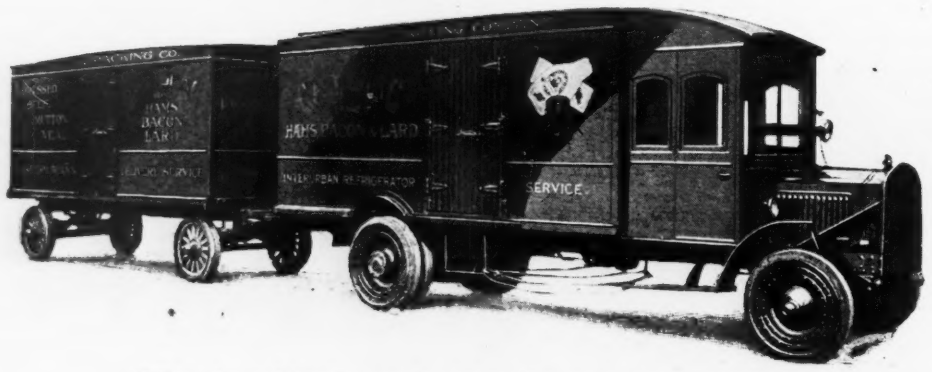
The *Wasp*, a triplane hydroplane that has established a record of 138 miles an hour. It is used by the government for training purposes

Carrying Perishables in Refrigerator Trucks

A new cooling system for refrigerator trucks occupies less than ten per cent of loading space

By Joseph Brinker

"IT can t be done — but here it is," was the slogan of the United States Army Engineers during the war. This terse ex pression held true in many phases of war work, but in no work to a higher degree than that which was performed by the common-place, every-day motor-truck.



With the refrigerator-truck trailer the motor-truck becomes doubly efficient in making long hauls of perishable foods. This way of carrying meat, milk, fruit, etc., is becoming very popular

True, the most spectacular work performed by motor-driven vehicles in the war was in actual war work, such as the saving of Paris by the fleet of taxicabs and omnibuses which threw a division of troops on von Kluck's flank on that memorable day at the Marne, and the feeding of the garrison at Verdun when every line of railway communication was cut.

But the work performed by trucks at home was also creditable—not because it was spectacular, but because it met unexpected conditions in a way that had never been done before. One phase of this great work was the haulage of perishable food products for distances of forty, fifty, and even sixty miles.

It began with fresh meat. During the summer of our first year of the war, in the railroad congestion coincident with the concentration of our supplies of men and material, one of the large Chicago packing-houses found it impossible to ship fresh meat by railway to its branches fifty and sixty miles away.

Wanted—A Refrigerator Truck

While that company had for years delivered meat at retail from its branches over routes fifteen and twenty miles long, it had never attempted to ship overland twice the distance by road on account of the spoilage in hot weather. A trip of fifty miles in the blistering summer sun would spoil the freshest meat.

While the roads were open and the trucks available, no type of refrigerator-truck body could be had that did not require that fully half the load be ice—and this was not a paying proposition. Finally an entirely new system of cooling, as tried out successfully on railway cars, was adopted to provide a refrigerator-truck body in which the cooling element takes up less than ten per cent of available loading space.

Brine-Circulating System

This system, in which brine is automatically circulated through a series of exposed pipes in the truck body, proved so successful that the Chicago meat-packer who first adopted it under the stress of war conditions is continuing it now in peace times.

Further than that, still more trucks, and even trailers, are being fitted with the new type of refrigerator bodies,

The ice-cream truck has special compartments for the ice-cream cans, for cracked ice, and for salt, the delivery for all of these being done from the ground

and employed to open up new territories not served by railroads. Thus the refrigerator truck has become an important business builder. While the ice - cream trucks are provided with ice and salt compartments, meat or other provision trucks use the entire length of the truck body for storage, their overhead cooling pipes extending the whole length of the body.

Following this first successful installation of the freely flowing brine truck body, the idea has been adapted to hauling milk over long routes, and the hauling of ice-cream through hot city streets, with the cream in better condition than has ever been possible with any previous type of body.

The development has been carried still further, and a general utility type of body has recently been delivered to the Post Office Department in Washington, D. C., and will be used in the collection and delivery of perishable fruits and produce on the long hauls of the rural parcel-post routes from the farm producer to the city consumer. The accompanying illustrations show the adaptation of the body for meat and milk, and for the delivery of ice-cream.

Better Refrigeration—Less Ice

As examples of the saving made possible by the new system and the higher degree of refrigeration secured, a carload of frozen beef that would take four days to travel from Chicago to New York by rail, stood for fifty-three hours after its arrival, with no change in temperature at the top of the car and a rise of only one degree at the floor.

Other shipments of meat, fruit, and vegetables from the Pacific to the Atlantic coast in cars with the new system have shown a reduction of from fifty to seventy per cent in the ice consumption alone. In addition, the system has made possible the increase of the loading space for about twenty per cent, since it eliminates the ice bunkers and brine-tanks of the ordinary refrigerator car. Briefly, the system

consists of a tank from which is run a series of nests of horizontal pipes along the under side of the body roof. The pipes are exposed inside of the body, and each pipe is made in the form of a U with the tops of the U open where they enter the side of the tank. One end of the U serves as an exit from the tank and the other opening as a return to the tank.

Filling the Tank

The tank is filled from the top with a mixture of ice and salt to form brine. The tank is divided in the center by a partition with check-valves. The swaying of the truck while in motion causes the brine to surge through the check-valves and pipes. When the truck is swayed to one side, the brine sloshes through the valves to that side; when it is jolted to the other side, the valves on the first side close and those on the opposite side open and the brine is forced through the pipes on that side. The result is a rapid and constant automatic circulation as long as the truck is in motion. This circulation absorbs the heat from both the body and its load. When the truck is not in motion, the power of the expanding brine is utilized for its circulation, which is again automatically secured without any cumbersome or intricate machinery to get out of order.

The truck has to be iced once a day and needs no further attention. From one hundred and fifty pounds to three hundred pounds of ice a day are required, depending on the size of the truck body. The temperature of the truck may vary from 25° to 40° Fahrenheit. It can be maintained and regulated by the amount of salt used.

Except for the details of the body, the system is the same for carrying meats, produce, fish, fruit, candies, and ice-cream. The ice-cream delivery body, however, is especially worth description in greater detail because of the unique arrangement of the compartments for the ice-cream cans, cracked ice, salt, and empty containers.

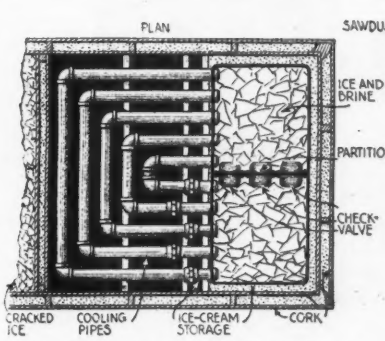
Each compartment is arranged so that the delivery of the ice, salt, and cream is all done from the ground. Since the cream is not packed, it takes only a few minutes to load. Similarly, much time is saved in making deliveries. Because the cream is carried in cans or bricks stacked on the floor, the driver does not have to mine the cans out of ice, as is the case with the ordinary type of body. The driver can also do more and better work in a day as a result, because his feet and clothing do not become soaked.

What Can the Motor-Truck Do in *Your* Business?

This is the second of the Popular Science Monthly's articles on business uses of the motor-truck. It explains how meat, fish, milk, fruit, even ice-cream, can be carried long distances at a low rate if the truck body is built like a refrigerator-car.

No matter what business you may be engaged in, no matter what may be the character of the freight to be hauled, a motor-truck body can be found to meet your requirements.

In next month's motor-truck article we take up the subject of loading and unloading. We intend to show that, like a railway transportation system, a fleet of motor-trucks must be operated from a properly equipped terminal.

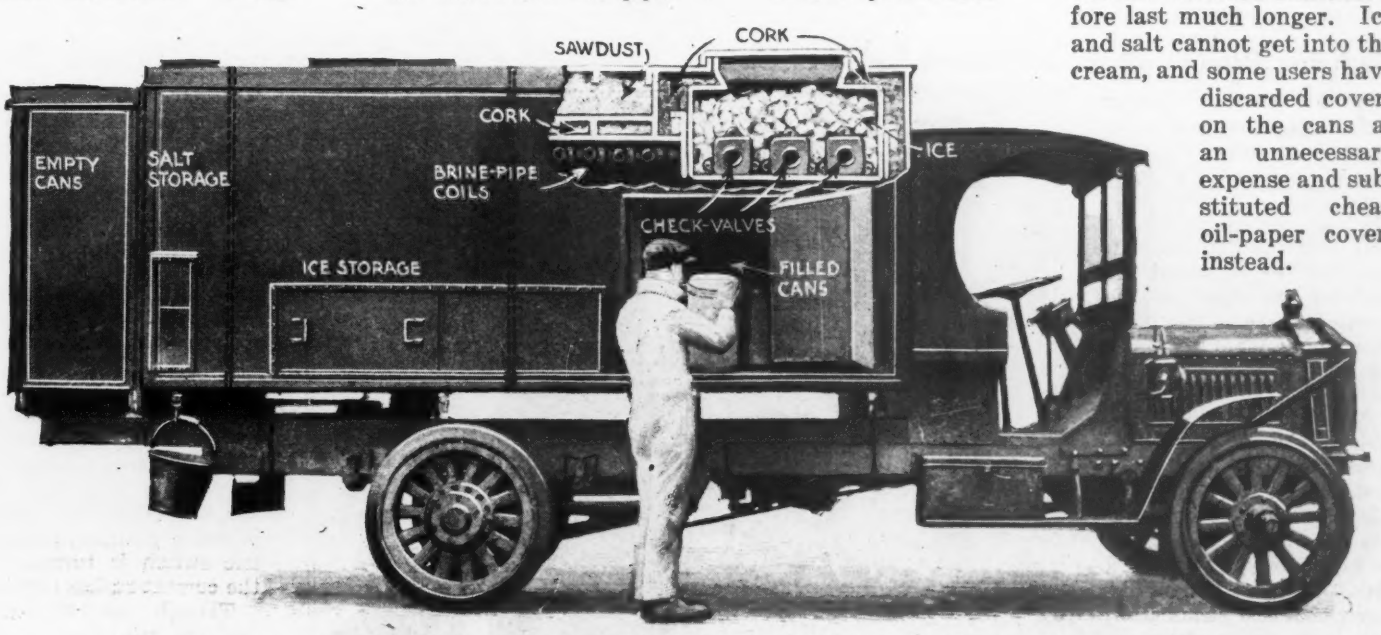


The tank is divided in the center by a series of check-valves, and the swaying of the truck in motion causes the brine to surge through the check-valves and pipes

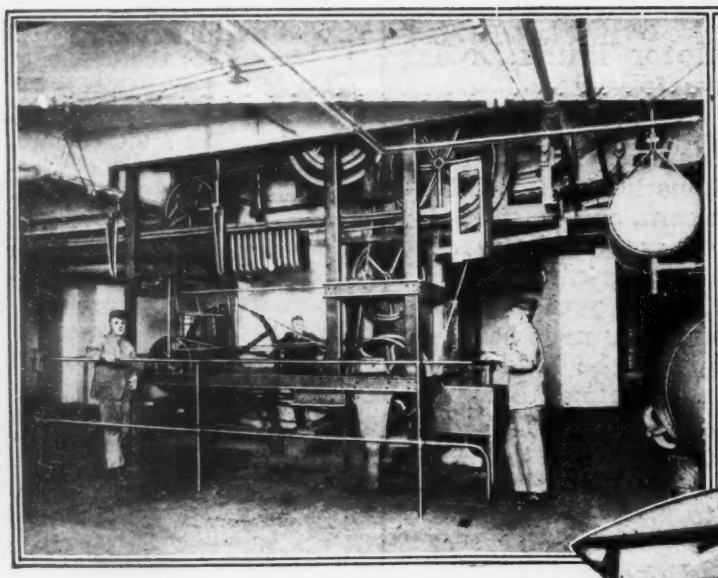
The ice-cream truck has a special compartment for cracked ice (see picture below). This is used for packing around the ice-cream in the cans just before delivering them to the purchaser

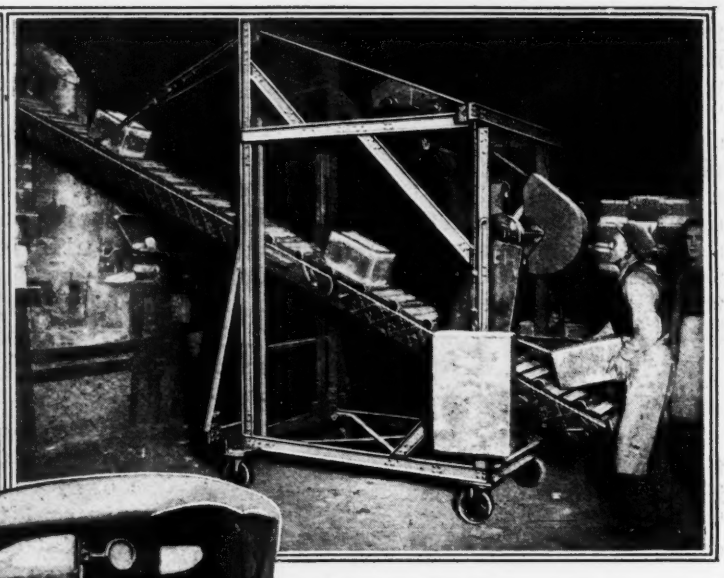
No More Corroded Pipes

Then again, the elimination of ice in direct contact with the cans on the body floor, and the fact that the brine is retained in a leak-proof system of pipes, at once does away with the greatest source of trouble—corrosion of the springs and rear axle parts due to leakage of water through the body floor. Because the cans are not packed in ice in the truck body, they do not become battered and therefore last much longer. Ice and salt cannot get into the cream, and some users have discarded covers on the cans as an unnecessary expense and substituted cheap oil-paper covers instead.



The refrigerator motor-truck body. Only a small amount of ice is required to maintain a low temperature. The expansion of the liquid provides continuous cooling during periods when the motor-truck is at rest





Getting Books to Congressmen

CONGRESSMEN are just ordinary mortals like you and us. When they are challenged to defend a new bill they telephone to the Congressional Library for text-books on the subject.

Now there is a tunnel that runs from the library to the Capitol building, and an electric basket carrier travels through it, the trip between the two buildings occupying exactly five minutes.

When a Congressman wants a book he communicates with the librarian. The book is found, put in a bag somewhat resembling a suitcase, then placed in the basket.

Then an electric button is pressed, and the book is on its way through the tunnel. The electric carriers are two and a half feet long, two feet high, and five inches wide. The tunnel is five feet wide and nine feet high, in other words large enough for a man to walk.

Something New in Duster Coats

YOU know how it is when you are driving along a country road and suddenly—*pop!* It's up to you to get out and put on a new tire.

It may be a beautiful road to look at, but dusty from lack of oil, in which case you will appreciate the duster coat pictured above. This coat is designed to render the wearer genuinely dustproof. The trouser feature of the duster will have a special appeal to the driver who does his own tinkering around the car. By bringing the coat-tails forward around the legs and fastening them in front, the clothes are protected from oil and dirt and the mechanician has freedom for any repair work to be done.

An Ancient Industry Modernized

THE illustration shows a conveyor that conducts freshly molded pottery into a kiln to receive such a "roasting" that it will be baked hard, but without allowing it to be damaged in any way.

The slow hand method of making pottery has given way almost entirely to the twentieth-century method.. Science has taken hold of that most ancient and historic of industries and has stimulated it with a dose of modern efficiency.

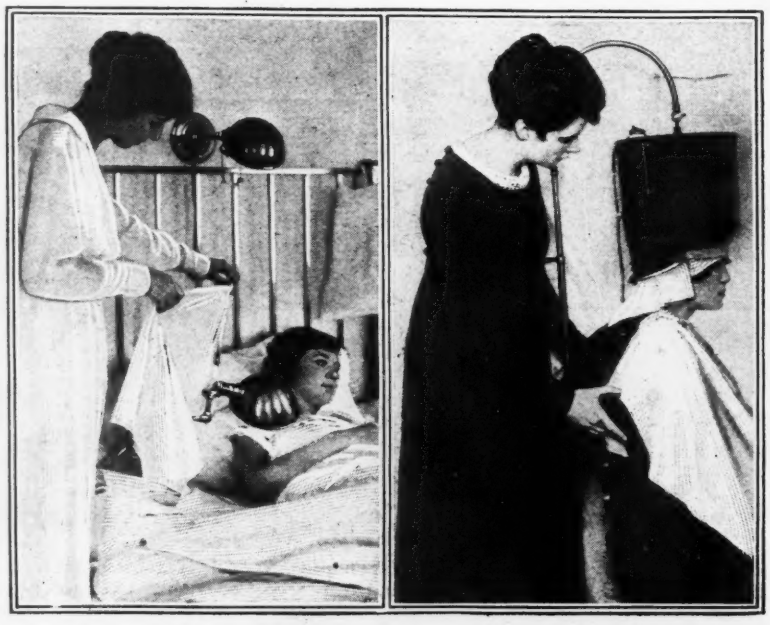
The conveyor is shown drawing up baked-clay forms which enclose the pieces to be fired. A thin strip of wet clay on the top (black in the picture) cements the top and bottom of form together.

The conveyor is carrying the forms into the kiln, where the firing takes place. The baked-clay forms prevent too sudden heating and thus save the pottery from cracking, a mishap that occurred frequently by the old method.

Fighting Rheumatism by Electric Light

DON'T become irritable if rheumatism troubles you. Take an electric light like the one in the picture, and place it beside you. Have a towel placed behind and over the light to concentrate the rays and the heat of the light on the rheumatic area. In a very short time the rays and the heat will begin to be felt.

When the heat becomes unbearable, put out the light. After you have cooled off a little, exercise the rheumatic portion and repeat the electric-light treatment and exercise several times a day. You will soon discover that the rheumatism has been driven from its lair and that "Richard is himself again."



Growing Hair without a Tonic

HOW many men and women have worried over the fact that their hair was falling out, and were inspired with horror at visions of bald pates in their declining years?

But in London the women now say: "See what my treatments are doing for me!" What kind of treatments? Electrical, of course.

A new invention is said to be doing wonders for thinly covered scalps. It is a large bag that fits snugly over the head. When in position, the electric switch is turned and the current rushes through.

Though uncomfortably hot, the treatment is said to have very beneficial results.

Something Unusual—A Pure White Coyote

THE only one in captivity—a white coyote—is shown below. When lying down he looks not unlike a nice dog, but his ambition in life is entirely different.

The coyote would like nothing better than to break loose some night, kill a few hens, and let forth a bloodcurdling yell that would frighten all the creatures for miles around.

Coyotes are usually brown in color, with black and white streaks. The tip of their tails is often black.

A pure white coyote such as this one is most unusual. As yet he has not misbehaved, but his keepers take no chances; they chain him to the wall of his cage.

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A Machine that Will Shine Shoes

IS a shine worth ten cents and a tip? No! But when Tony has shined your shoes and looks up at you with a broad Italian smile, you overrule your own veto.

Now, however, there is a mechanical shoe-shiner run by electricity. Tony simply directs the machine. Large "don't-tip" signs are hung in conspicuous places. The illustration shows a black and a tan shine in process of operation.

© Univ. Film Co.

Mowing the Front Lawn with a Motor

ADMIRAL Sir Percy Scott comes to the front again—this time as the inventor of a motor driven lawn-mower. He is shown below oiling his new mower before directing it across the lawn.

The mower has a chain drive, and its speed may be regulated to suit. The operator guides the mower on its way, but does not have to push it. The grass is cut much more evenly by the motor-driven mower than by the usual hand-operated one. No more difficulty in persuading the son of the house to mow the lawn!

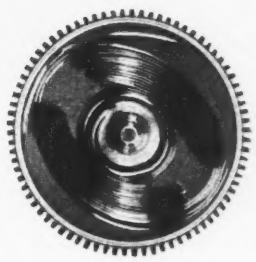
© Int. Film Co.

One Man Runs Stump-Sawing Motor

SOME tree-stumps are left alone; others again are pulled out of the ground; others are sawed off even with the ground. Arthur Hamilton, of Harrisburg, Arkansas, has invented a new stump-sawing machine that levels stumps and is operated by one man and a motor.

The motor and the frame that holds the saw are mounted on a sled that can easily be pulled from stump to stump. The saw is attached to flexible cables fitting over guide rollers and terminate in a block at the top of the frame. Attached to this block is an arm that moves back and forth when the motor is started, causing the saw to do likewise.

The man has nothing to do but adjust the machine to the proper position in the beginning by means of a lever at the end opposite the motor. The base is pivotally mounted, enabling the saw to get into any position.

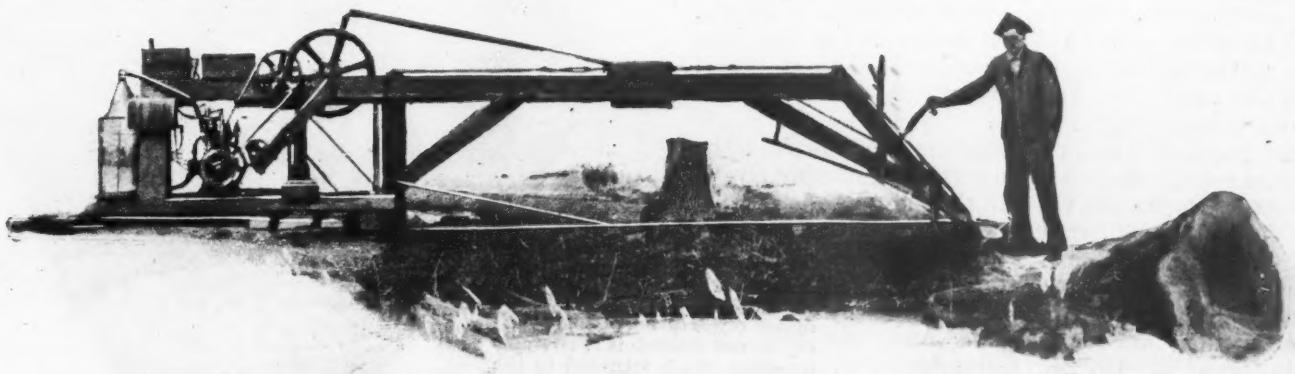


A Watch that Has a Mysterious Spring

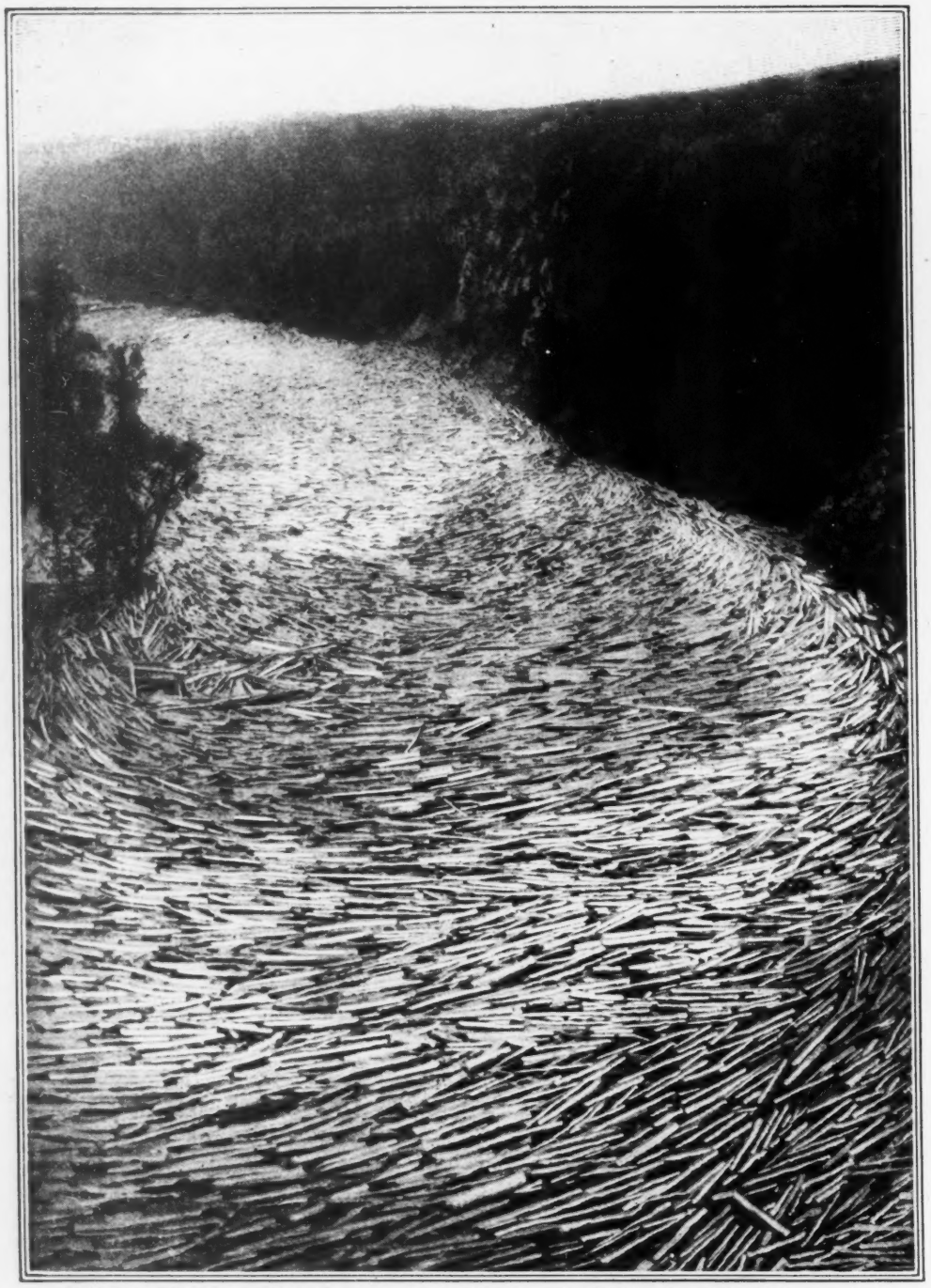
"MY watch has stopped again," said Allen Jay, of Richmond, Indiana, in an exasperated voice. He had just had a new mainspring put in the watch that very day. When the watch was examined it was found that the mainspring had broken into twenty-two pieces!

The watch had not been dropped or handled roughly. Closer examination revealed the interesting fact that each coil of the spring had broken exactly in half. No one has been able to solve this watch mystery—can you?

The steel from which watchsprings are made is usually above reproach in the fine quality and care of its making. Under the microscope a piece of crucible steel shows a remarkably fine granular structure. It is heat-treated so as to give it the proper "spring." Its composition is such that so curious a freak of breaking is most unusual.



August, 1920



Millions of logs completely cover the ice on this river in British Columbia. When spring comes and the ice melts they will float down to the mill, which is sixty miles away

A Canadian River of Wood

IN British Columbia there are two hundred million acres of beautiful full-grown forest lands. About nine hundred million feet of the timber, valued at twenty million dollars, is cut each year—usually during the wintertime. When the logs are ready to be milled, they are thrown on the ice-covered river and left there. Then as spring comes and the ice melts the logs float down to the mill many miles away. Men are stationed along the bank who, by means of long poles, keep the logs from becoming jammed.

This method is more expeditious than forming the logs into rafts, which is done on slower-moving rivers.

When the logs reach the mill they are sawed and then sent on their way by rail. Much of the wood is exported. England, South America, Australia, Africa, China, Japan, Germany, and France, all depend on British Columbia for some of their lumber supply. And so do many of British Columbia's sister provinces.

X-Raying the Oyster for Pearls

UNTIL very recently the oyster of the pearl-bearing variety has been cut open and searched. If no pearl was found, its life had been sacrificed in vain, and any future chances it might have had of developing pearls were ruined.

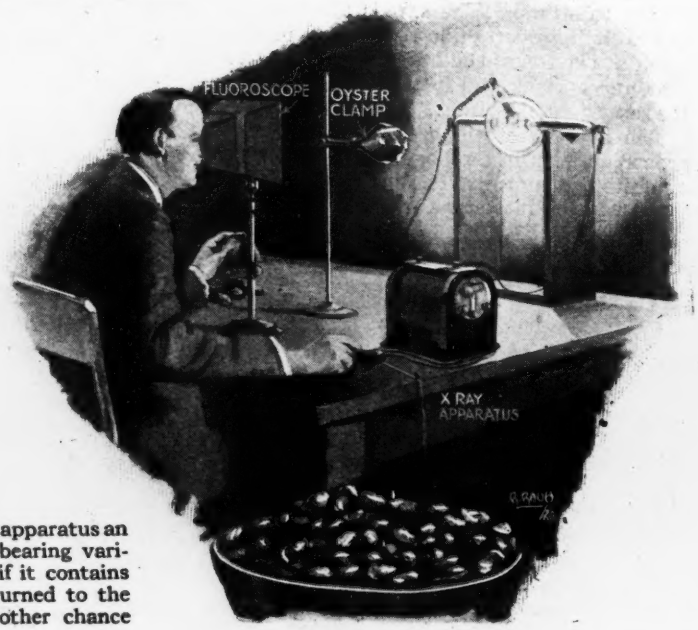
But the X-ray will save the life of many a precious oyster of this species. This method was first suggested by Raphael Dubois, of Lyons, France, in 1901, but it was not tried out until recently. The pearl oysters that breed in Ceylon and Venezuela are thin skinned, and it is easy to discover whether or not they contain pearls. If no pearls, or very small ones, are discovered, the oysters are returned to the beds uninjured.

Oysters having rough and irregular shells are not so easily tested. Only large pearls may be detected.

In the places where pearl oysters are usually found labor is very cheap and as yet the new method has not received much attention. But as pearl-bearing oysters grow scarcer the X-ray will undoubtedly become more popular.

Although the shell partly interrupts the radiations of the X-ray, it is not difficult to recognize the presence of large pearls. Those engaged in the pearl-growing industry cannot overlook the fact that with this highly perfected apparatus it will be possible to save growing pearls which otherwise would have been wasted when the shells had to be opened to discover them.

Considering the fact that pearls are becoming more valuable each year, this process should commend itself to pearl-culturists generally.



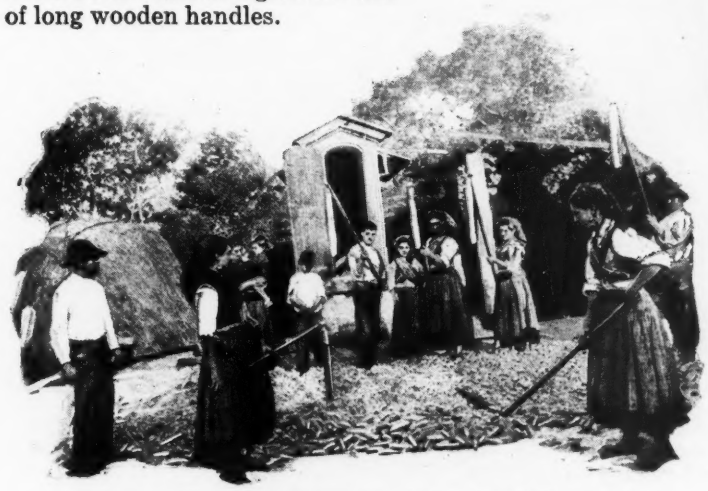
By using this X-ray apparatus an oyster of the pearl-bearing variety is not wasted if it contains no pearl. It is returned to the beds and given another chance

A Portuguese Shelling-Bee

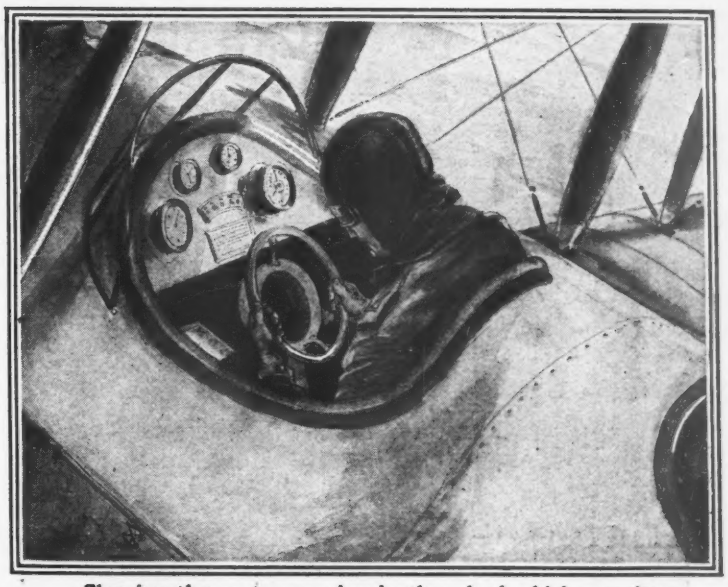
ARE you short of farm help? Take a tip from the Portuguese. When their corn is ripe and ready to be shelled, they invite their neighbors to a shelling-fête. Wine and cakes are served and corn-beaters are handed around. The ears of corn are dumped on sandstone slabs and beaten vigorously, and in a short time the corn is shelled. If you have some wine or even beer—it's very easily made, we're told—you can employ your neighbors in like fashion.

Corn is an important article of food in Portugal. The climate is good for corn growing and there are very few districts where it is not cultivated.

The corn-beaters used in the picture below are made of corkwood and swing on the end of long wooden handles.



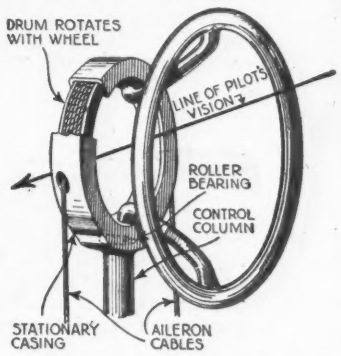
When shelling-time comes in Portugal neighbors help each other—like the American quilting or husking parties



Showing the center opening in the wheel which permits the pilot to see the instrument board, also his target

Sending the Bomb Straight

IF the pilot of a torpedo plane could not see the instruments which enable him to direct the bomb upon a true course, the results would be disastrous in the extreme. The handwheel of the Blackburn Blackburd torpedo plane is made so the pilot finds little to obstruct a clear view of his instruments, and he can look through the opening in the board both forward and downward, making no mistake when he turns loose the deadly missile.



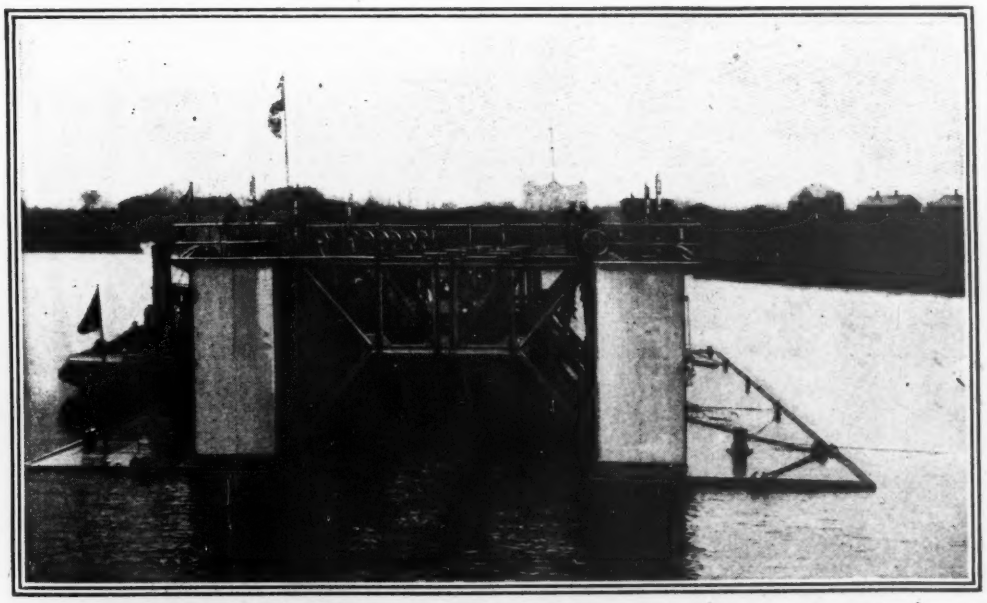
A diagram of the handwheel showing the position of the roller and the aileron cable with various other interesting details of the mechanism

The handwheel is so constructed that only two spokes are necessary to connect the rim with a drum grooved to carry the aileron wires, the drum also forming the inner member of the control-wheel bearing. A roller at the end of the control lever enables the wheel to be turned without friction. The pilot can thus conveniently manipulate the wheel and look through it at the instrument board, while also in position to look without obstruction through the center of the wheel and the board down at his target.

It Digs Up Germany's Sunken Ships

WHILE Germany was sinking ships, hers were being sunk. And now she is just as busy as we are inventing salvaging devices. Below you see an immense floating drydock, recently built at Kiel.

The drydock is towed to the spot directly over a wreck. Water is admitted into the pontoons and the divers get ready to go down. Huge chains that wind around pulleys are lowered into the water and fastened underneath the wreck by divers. When the wreck is well chained, the pontoons are pumped out and the wreck rises.



This floating drydock is Germany's latest invention for raising sunken ships. It is towed to the spot directly over a wreck; chains are fastened around the wreck; the water is pumped from the pontoons and another valuable ship is salvaged

What We Have Learned about Wood Preservatives

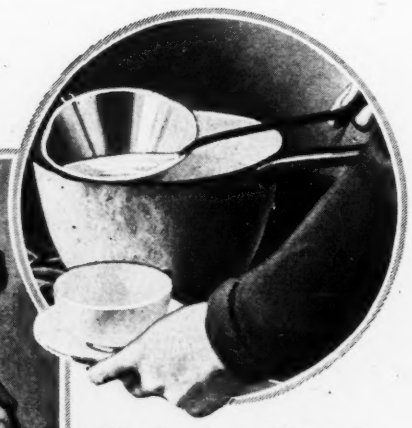
ZINC chloride and creosote are often used for preserving wood, but it has been found that sodium fluoride will do as well. The Forest Products Laboratory thought that laboratory tests did not sufficiently prove this, and so in 1914 sap-pine ties were treated by the three preservatives and placed side by side. After five years they were examined. Those treated with creosote were in the best condition and those treated with zinc chloride and sodium fluoride showed but little decay.

Housekeeping Made Easy

Keep step with the times and lighten labor

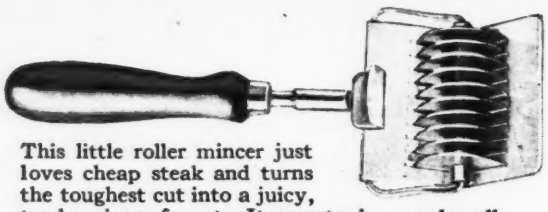
In using a fork for turning cooking meat the juice escapes. This meat fork has two parts with three wide prongs on each. When the handle is gripped the parts clamp the meat fast

A rackful of soiled dishes is placed in the machine, the water turned on, and a whirling spray above and below the rack thoroughly cleanses the dishes. A drain carries the refuse and water into the sink

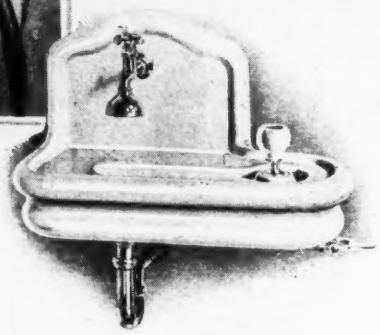


Here is a clever scheme of getting soup from a kettle without any grease, and it is entirely practical. Insert a funnel in the soup and remove the grease-free soup from center of funnel

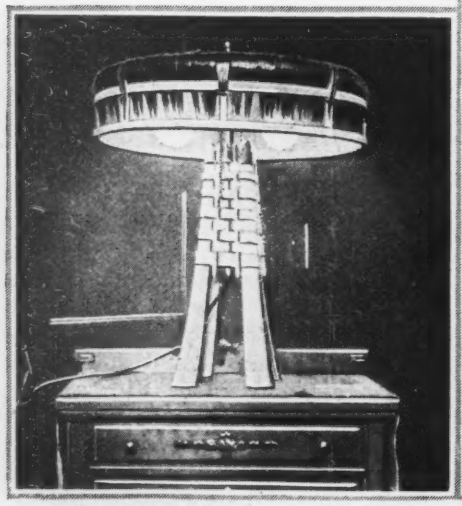
This novel container keeps a variety of eatables hot until wanted. The container is made of insulated steel and the four food dishes of insulated glass are ready at any time to be placed upon the table without the necessity of transference to other dishes



This little roller mincer just loves cheap steak and turns the toughest cut into a juicy, tender piece of meat. It operates by merely rolling the cutting wheels over the meat to be minced

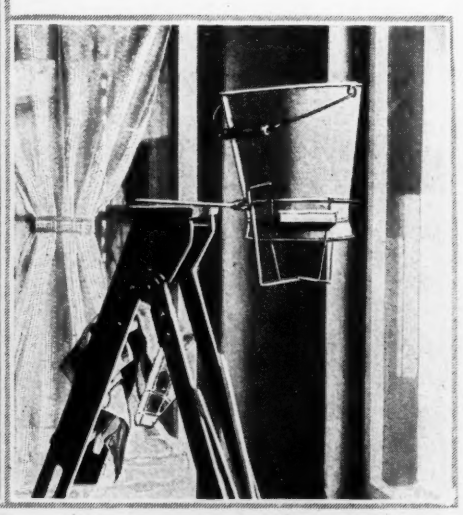


For eliminating the cumbersome ice-cooler in a restricted amount of space comes this combination drinking-fountain and bubbler. The water faucet is equipped with a special non-splash outlet. The porcelain makes this a fixture that is easily cleaned



A new table-lamp is made from palms dried and enameled white at the base. The shade is of palm leaves in their natural color with the stems enameled to match the base

Window troubles may be avoided by using windows embodying all parts in one unit; everything but the wood trim required for finish. It has all the appearance of an ordinary window

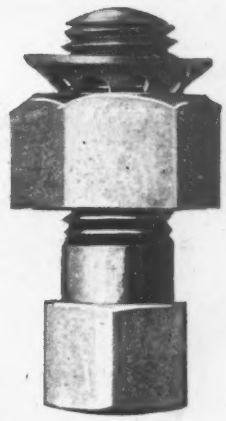


No more need you climb down the stepladder to rinse your cloths. This wire rack has squeezer, brush-holder, and pail-holder connected with the topmost step of the ladder

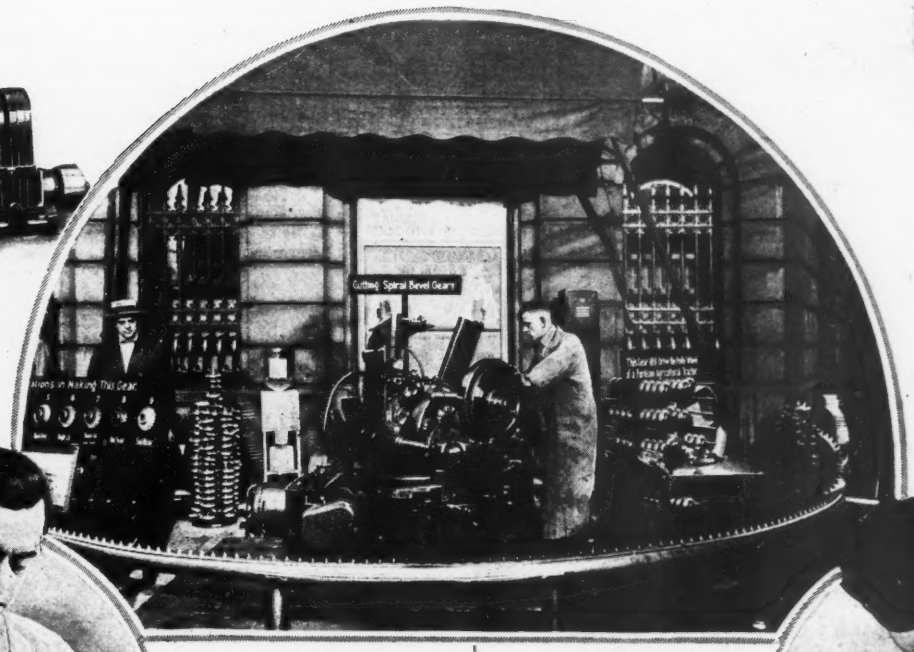
Do It with Tools and Machines

Mechanical aids to big production

This is one form of tachometer, an instrument which tells how fast a shaft is turning and displays the reading on a dial



This new nut lock firmly retains its position on the bolt, whether the nut is tight or loose



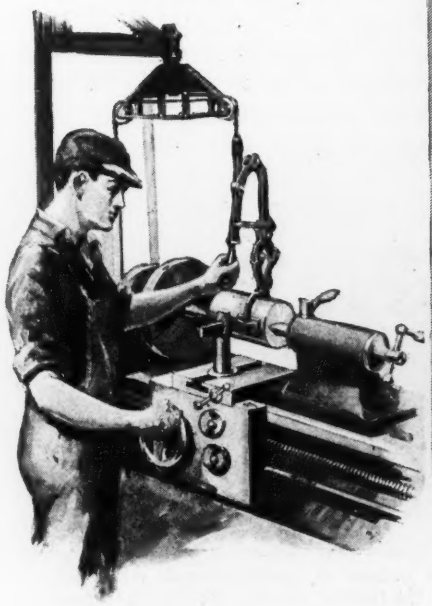
Unusual in the extreme was this Cleveland street-corner exhibit of a machine actually cutting gears. To many of the spectators, it was a gear-cutting education never before obtainable except inside a big manufacturing plant

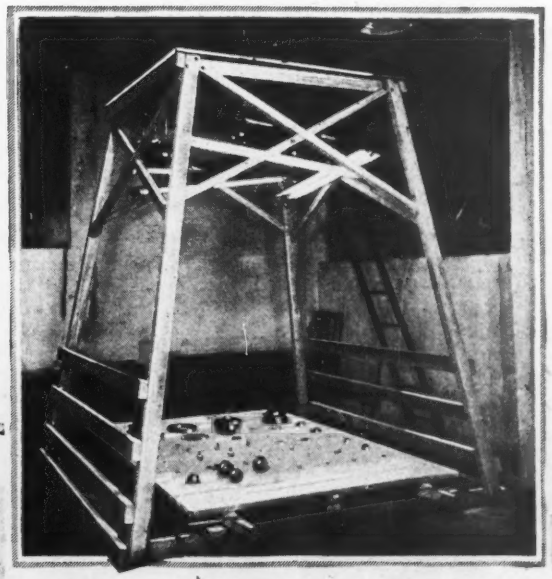
Each scale clip is made of spring steel, and can be adjusted for scales of different sizes by applying pressure on sides or top

This new oil-can has a flexible spout which is practically unbreakable and which can be bent to reach places that cannot otherwise be oiled

The vest-pocket thermos bottle holds almost a cupful of hot coffee for the mechanic who has to work in a chilly shop. Its unusually small size enables one to carry it conveniently

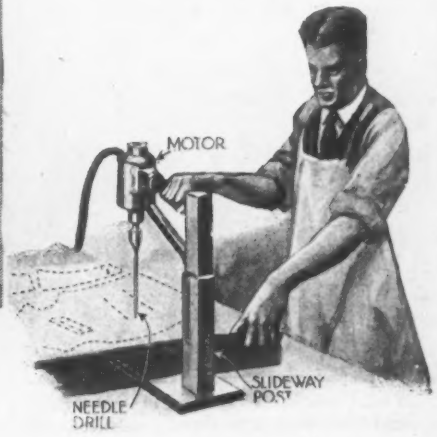
This combined machine tool and lathe is designed to facilitate the operation of placing work in the machine and removing them

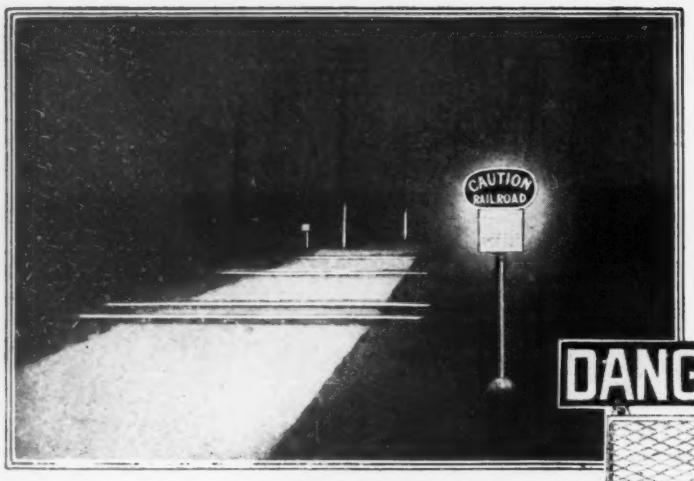




Photographing automobile and machine parts is made simple by arranging the parts on a platform slightly raised from the floor, and having the camera take the exposure from overhead with the lens pointing downward

When the cloth-cutting machine has cut out the cloth, this machine drills holes which indicate the position of the pockets, etc., thus aiding the manufacturer to speedy production





The silent watchman throws your headlight rays back at you with a red glare, warning you that there is danger ahead

The Sun Works This Signal

UTILIZING the rays of the sun in the day and headlights of an automobile at night, a highway railroad-grade crossing-signal has just been perfected which works on the principle of the angular reflection of light-rays.

No doubt you have often looked out of your window and seen something shining on the ground. You were curious, investigated, and found that the shining was caused by a piece of broken glass so located that it caught the sun's rays and diffused and reflected them back to your eyes.

Try to imagine a square one foot to the side reflecting a red light instead of a white one and you will understand the principle of the new automatic signal. In daylight the sun's rays reflect the red light. At night the rays from the automobile headlights accomplish the same purpose. The signal is five feet high.

But the real problem was to make a white light thrown on the signal reflect a red light. This was accomplished by developing a special ruby glass, which with a mirror in back of it will reflect a red instead of a white light.

There are thirty-six different reflecting planes in one twelve-inch-square lens.

The signal body is supported by two heavy angles so fastened to a metal post driven into the ground that radial and anticlinal adjustments diffuse the red rays properly.

The railroad-grade crossing signal shown in detail

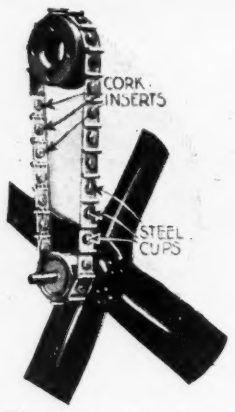
A Cork-and-Metal Fan-Belt

WHILE all kinds of materials and material combinations have been tried for automobile fan-belts, none met with success until the introduction of the all-metal type shown here. Because it is made of metal, this type of belt cannot stretch or shrink to such an extent as occurs with leather or fabric.

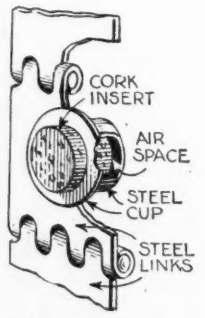
To permit the metal belt to take a curved semi-circular shape, it was necessary to make the belt in short lengths. But a metal belt running on a metal pulley would slip, so the belt manufacturer cut a hole in each length and inserted a cup-shaped metal piece through it from the side touching the pulley.

Then a thin disk of cork is forced into each cup, leaving an air space between the bottom of the cork and the bottom of the metal cup. The cork grips the pulleys over which the belt runs and transmits the power without slipping.

The air between the cork and the bottom of the cup provides a permanent air cushion which makes the belt noiseless and slipless.



The all-metal fan-belt with cork inserts will not stretch or shrink. It is noiseless and non-slipping



Thin disks of cork are inserted in the metal belt lengths thus preventing it from slipping on the pulley

Turkey Wants American Tractors

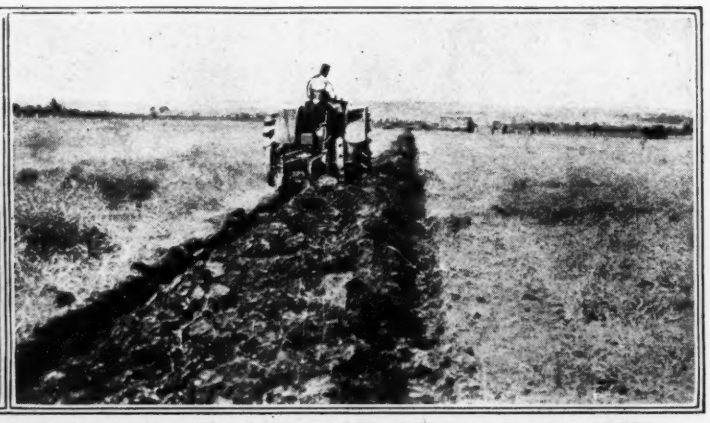
FROM oxen to horses to tractors have been the usual steps in the evolution of farming in most countries, but Turkish farmers are skipping a step, and changing from the plodding, swaying oxen direct to the modern tractor.

They have been quick to see the great advantage in using a tractor over their old custom of using approximately six oxen to one plow. By this modern method, they say, they can accomplish their own salvation through the cultivation of their large areas of fertile soil that have lain idle for many years.

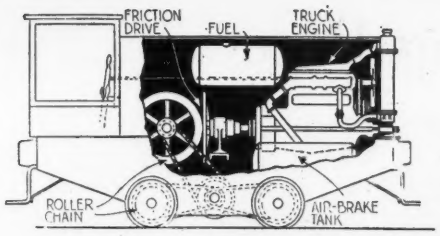
Every demonstration draws a crowd of keenly interested farmers, who watch closely and comment freely. At one demonstration near Constantinople, where the tractor plowed eight-inch furrows in a large tract of land that had not been plowed for over a hundred years, one wearer of the fez said that it would take twenty oxen to plow such furrows.

Many such incidents as the above may be gleaned from reports of United States consuls, making insistent the cry for greater production.

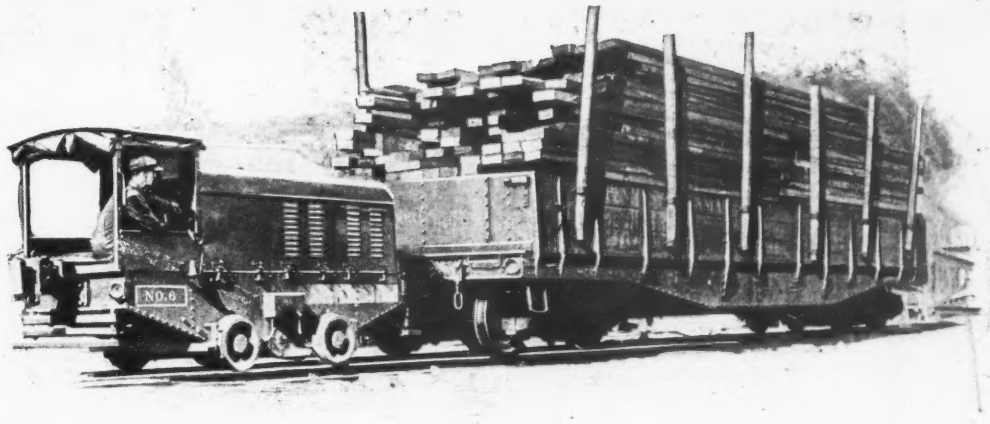
The Turk formerly used six oxen to pull his plow. But now eighteen oxen and three plows are eliminated by one tractor



Here is a piece of land just outside of Constantinople which has lain idle for years. Notice the tractor plowing eight-inch furrows



The gasoline mule has this advantage over the small industrial locomotive. Its mechanism is understood by the thousands of men who understand the driving of automobile and motor-truck, and therefore its potentialities for use are enhanced considerably



Behold the Gasoline Locomotive, a Rival of the Steam-Engine

DUE to the great scarcity of all forms of steam-railway equipment during the war, the gasoline locomotive gained considerable headway. As a result, there has been developed an improved type of gasoline locomotive. This new apparatus, which is offered in four- and six-ton models capable of hauling eighty- and one-hundred-and-twenty-five-ton loads on straight and level track respectively, is characterized by the close adherence to automobile- and motor-truck-designing practice.

Aside from the self-contained unit, when a gasoline engine is employed as compared with the boiler and tender for coal and water of the steam type, the use of automotive design in locomotive construction makes the machine readily operatable by the many men who understand the automobile and truck, but not the steam-engine and boiler.

The one feature which formerly was quite common automobile practice, and which is used on the locomotive for its great simplicity, is the friction disks for the transmission of the engine power to the propelling wheels. A metal disk is mounted on the rear end of the engine crankshaft. Against this disk and at right angles to it is a second disk mounted on a shaft which drives the locomotive wheels by a system of roller chains.

The different driving speeds are obtained by moving the second disk along its shaft so that the point of contact on the revolving engine shaft or driving disk changes from the center of the driving disk to the periphery of the disk. The speed of the driven disk increases as it is moved toward the circumference of the driving disk, while the reverse speed is secured by throwing the driven disk beyond the center of the driving disk on the opposite side.

Making It Easy to Change Tires

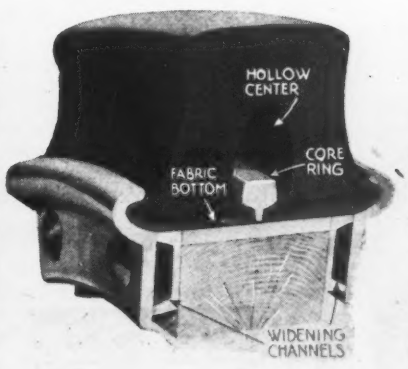
ANY one who has seen an automobile tire taken off its rim by means of screwdrivers, hammers, spring leaves, etc., will appreciate how that disagreeable task may be overcome by the simple split-rim contractor and expander shown in the accompanying illustration.

The apparatus consists of but three parts: a center turnbuckle and two end members. One end of each end member is threaded to screw into the turnbuckle and the other end is provided with a hook to fit over the edge of the rim. Thus when a tire has to be taken off a rim out on the road, all that has to be done is to hook the end members over the rim and take up on the turnbuckle. This contracts the rim as shown, so that the tire may be taken off in a few seconds and without prying, hammering, or damaging the rim or the casing. The tool weighs only three pounds and comes in a kit twelve inches long. It will fit into any tool-kit without making it bulky.

While tire-changing can never become a task of joy unalloyed, this ingenious invention will considerably alleviate the sorrows of the automobilist, to say nothing of the time that will be saved for happier occupations.

The split-rim contractor and expander fills a long-felt want for the motorist

This view shows how the use of a hollow center permits the tire to ride over a stone without damage



The tire is a cross between the solid and pneumatic type; it is split at the center and provided with a core ring as shown

Getting 50,000 Miles from Motor-Truck Tires

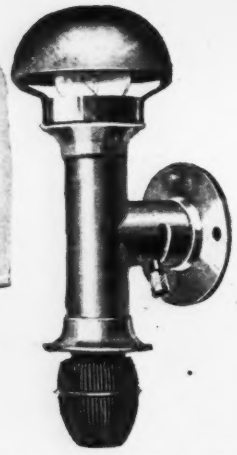
MOST automobilists are satisfied with eight thousand miles from their pneumatic tires, and truck-owners if they get ten thousand miles from their solid tires. A new type of cushion tire has been designed for use on all four wheels of trucks up to one-ton capacity and for the front wheels of trucks up to two-ton capacity. It has given as high as fifty thousand miles under exceptional conditions.

The main constructive feature of the tire is its hollow center, which permits the tire to absorb a good-sized stone.

Keeping Pace with the

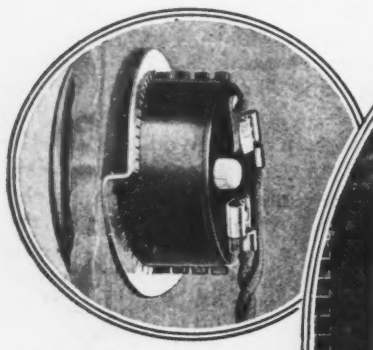
Some novelties recently

This trailer is a veritable home on wheels and provides sleeping room for two people. The trailer is constructed of rolled sheet steel and is very light



A new dash lamp has two sockets, one carrying a permanent lamp for lighting the dash instruments, the other being used to plug in a trouble lamp, etc.

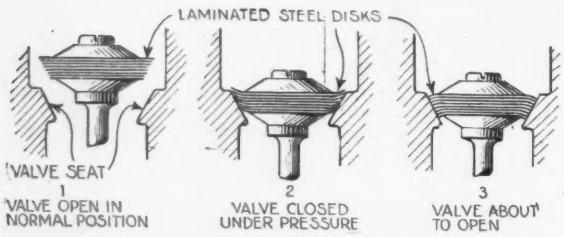
One of the standard automobiles has a neat little compartment for gloves and goggles. It is out of the way and yet it is also within easy reach of passengers on the rear seat



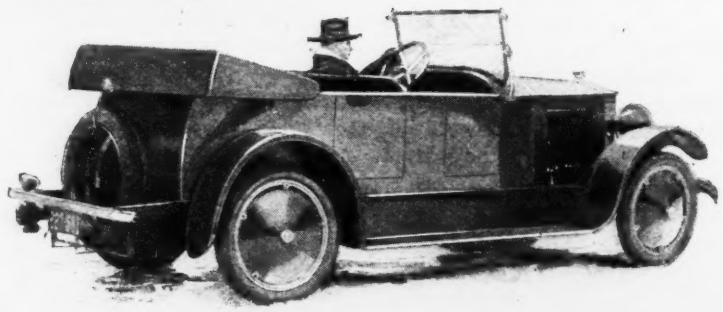
An electric automobile clock operated by current from the storage battery is the latest in automobile accessories. Its inventor states that the clock consumes less current in a year than the dash lamp does in one hour

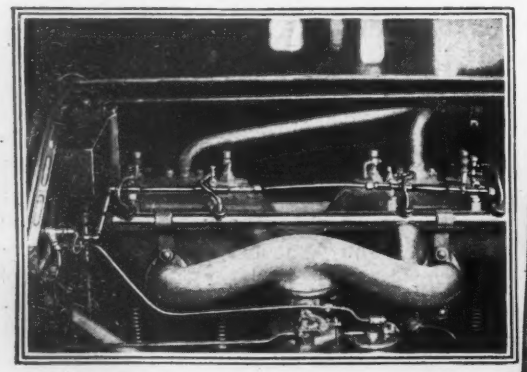
With a swinging crane and by means of a short hose the gasoline tank can be quickly filled. When the crane is not in use it swings back to an inconspicuous position against the wall

You could study this car for a long time without discovering what make chassis it is built on. After you give up we will tell you it is a Ford. The front seat is adjustable



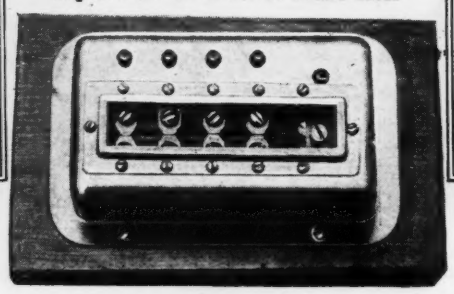
Automobile engine valves made of thin laminated disks of steel which do not need grinding

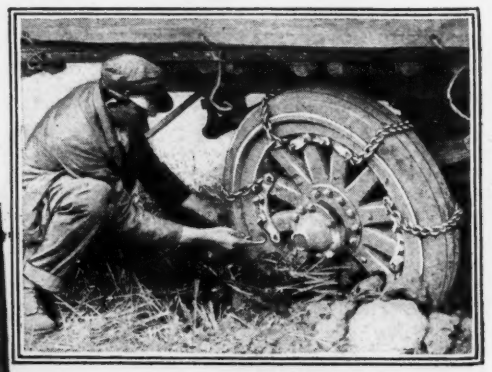




A new multiplex air-pumping spark plug acts as a self-starter for any automobile. Each plug is a primer, oiling cup and relief valve all in one

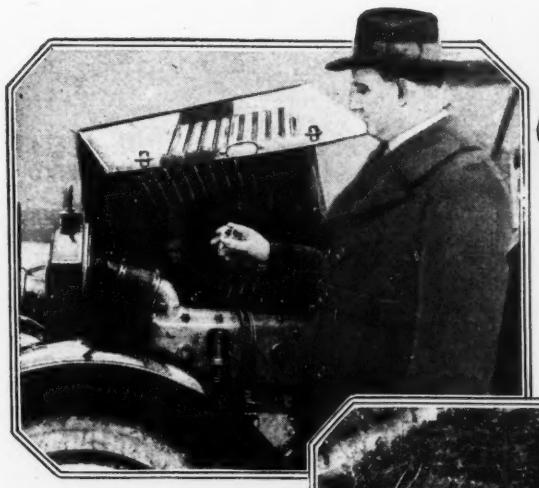
This device is very useful to the automobilist. It will intensify the spark, save trouble with carbon and poor gasoline, and show the driver at all times if the ignition system is working properly. He need not stop the car in order to make tests





Easily adjusted non-skid chains for motor-trucks are fast coming into prominence. Here is a new kind which are clamped on the tire in sections

Motor-Accessory Makers
placed on the market



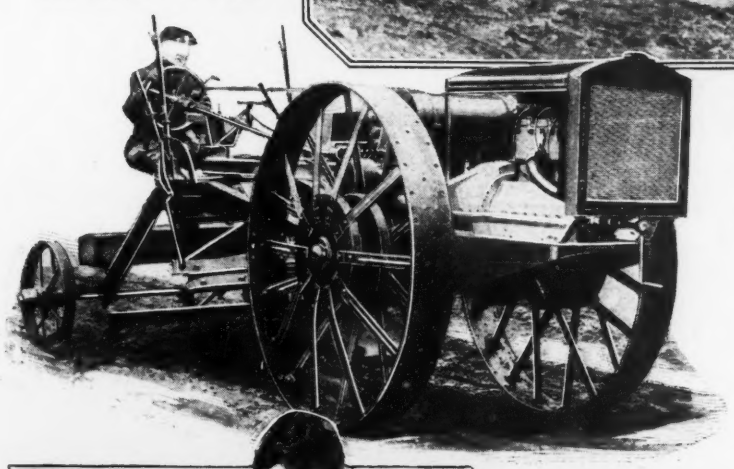
This spark-plug has a neutral gap to provide a double circular gap mounted high from the insulator, thrusting a chain of sparks well down into the gasoline

The automatic road guide indicates the car's exact position on the road

A fender which automatically drops when the front bumper of the car strikes anything

This tractor, being built on the two-wheel principle, most of the weight is placed on the driving wheels, enabling it to get great traction and draw-bar pull

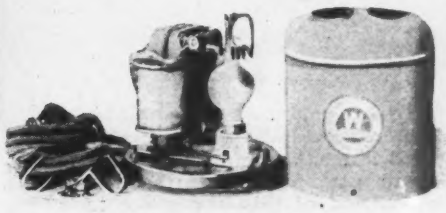
The inside, triangular-shaped part of this three-part piston-ring has a wedge action that goes upward, downward, and outward



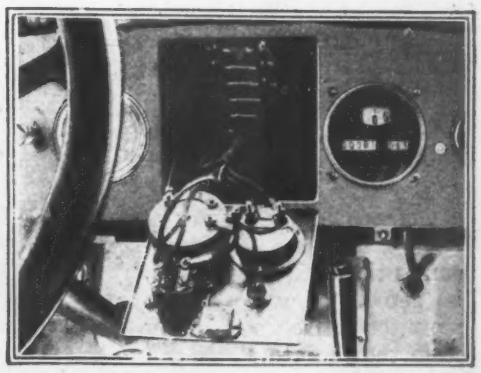
In a recent motorcycle contest held upon a mountainside with a fifty-per-cent grade, out of fifty contestants only two reached the top

A piston-ring compressor in the form of pliers pulls a wire tight around the piston-ring, thus permitting it to be easily inserted into the cylinder

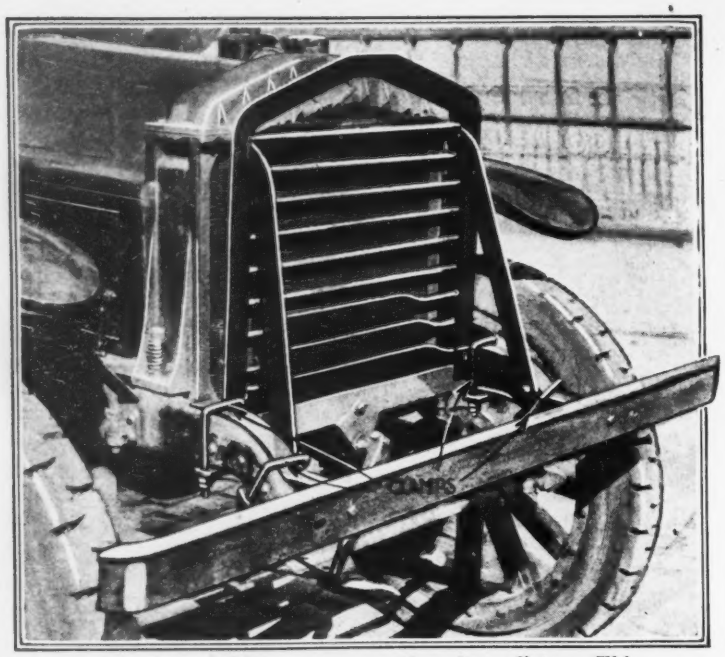
One can get around the terror of cleaning springs by attaching two scrubbing-brushes to the end of a mop-stick



The connections and operation of this battery-charging apparatus are very simple. The weight is only ten pounds and it has a cover which enables it to be carried easily



Making the instrument and fuse-wiring connections instantly accessible, a new car has them on a hinged plate



A motor-truck is no stronger than its radiator. This iron guard prevents it from being injured accidentally

Radiator Guard and Bumper Combined

THE radiator of the motor-truck is one of its most vulnerable parts. All of our war trucks shipped abroad were equipped with radiator guards, because they were to be used in convoy formation and operated by more or less inexperienced drivers. The experience gained with radiator guards abroad has shown that they are equally as efficient in every-day, peace-time work. In fact, they are one form of truck insurance that helps to keep the truck earning money by reducing the time for radiator repairs.

As a result of this need for radiator guards, many different types have been placed on the market since the war. Many of these, however, were not entirely suitable because of their clumsiness or difficulty in mounting. Some others were attached directly to the radiator casing, so that whatever blow was struck on the guard was transmitted directly to the radiator itself—and resulted in radiator damage either to the core or the casing.

One of the later types of guards, and one that overcomes these disadvantages, is shown above. It is mounted entirely separately from the radiator, and can be fitted in a few moments' time by the truck driver with an ordinary wrench.

A Post-Office at Your Door

DISTINGUISHED as the first of its kind in the United States, the operation of a "rolling post-office" in Washington, D. C., promises to speed the collection and delivery of parcel-post packages in the congested areas of the national capital.

Although inaugurated at the Christmas season, when the facilities for clearing the mails are most severely taxed, the post-office on wheels is to be a fixture in the collection and delivery system in a city where franked matter has no off day.

The diminutive office is equipped with all the facilities for handling parcel-post packages, which are receipted by uniformed postmen. The truck is six feet wide and six feet long. The equipment consists of a lobby, a counter, two doors for patrons, steps, windows, a stove, and electric lights.

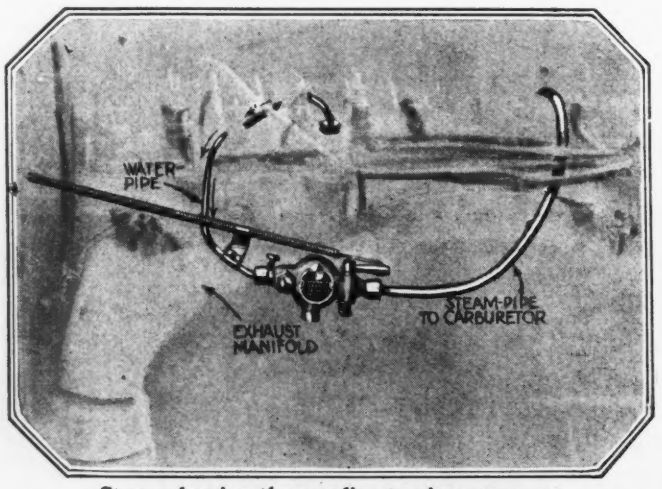
Not unlike the peanut vendor whose goober-parcher capitalizes the tramping-grounds of the congregated floating population, the movements of the post-office on wheels are subject to the fluctuations of the parcel-post business in various sections of the city. As a clearing-house it may remain stationary for a week, only to move elsewhere when business slackens.

The post-office on wheels, an innovation of the United States government, serves as a clearing-house in congested districts

This innovation in post-offices was introduced to the service amid a spectacular parade, viewed by thousands as it moved up Pennsylvania Avenue. The maiden journey through the streets was made at the head of a procession of thirty-five parcel-post trucks. Seeing the picture, you'll not be surprised that it was one of the most popular exhibits.

Feeding Steam with Fuel

A NEW steam carburetor for gasoline automobile engines has recently been perfected to give more engine power and reduce the carbon formation. Its action is based on the idea that when steam is injected into gasoline there is a chemical reaction in which the carbon of the fuel and the oxygen of the water combine to form carbon monoxide, and set free the hydrogen of the water.



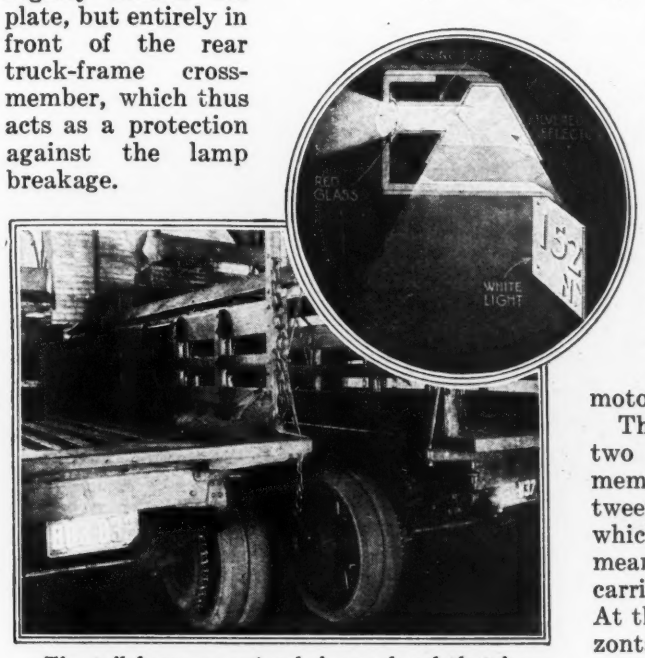
Steam-cleaning the gasoline to give more engine power and reduce the carbon formation is the function of this new steam carburetor

The cylindrical mixing-chamber for the steam is screwed into the exhaust manifold. A pipe is led from the water-jacket of the engine to the mixing-chamber, where the exhaust gases splash the water into steam and from where this live steam is then sucked into the carburetor and into the cylinders with the regular fuel through a second pipe leading from the mixing-chamber to the carburetor.

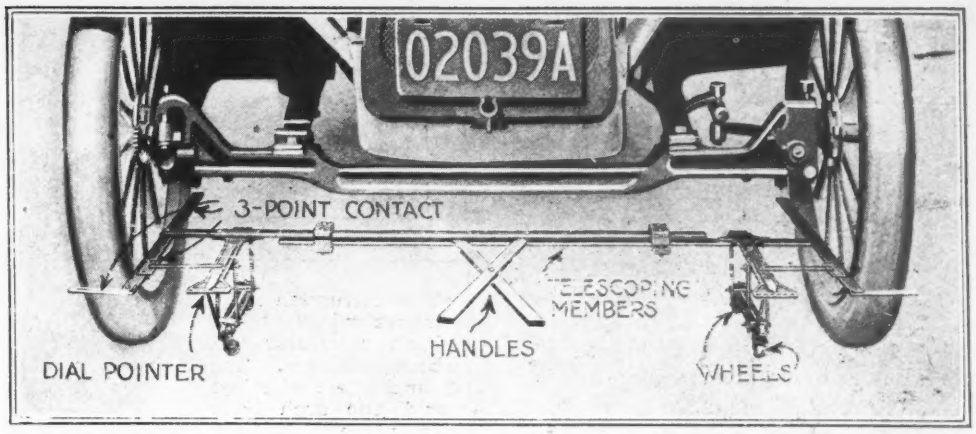
Protecting the Motor-Truck's Tail-Light

LAMPS for lighting the license plates on motor-trucks are usually placed in back of the license plate. In such a position, the lamp is unprotected and is often broken, either by being bumped into by the front end of a following vehicle when the body overhang is small or by backing up the truck against one of the walls of the garage in which it is maintained.

To overcome light breakage due to either of these two reasons, one truck-owner in New York city devised the novel method of protection shown below. The lamp is placed above and slightly behind the plate, but entirely in front of the rear truck-frame cross-member, which thus acts as a protection against the lamp breakage.



The tail lamp on a truck is so placed that in many instances it is easily broken. An ingenious method of preventing this accident is shown here



A device which eliminates guesswork in truing up automobile wheels, and by which one man can test more wheels in less time than two men could using the old methods

Truing Up Automobile Wheels Accurately

IT was to overcome the complication of previous truing-up methods that J. F. Duby, of Mattapan, Massachusetts, invented the type of wheel gage shown in the illustration. The instrument tells instantly whether or not the wheels are out of line. It can be used for either the front or the rear wheels of automobile or motor-truck.

The apparatus consists of two horizontal telescoping members which are placed between the two wheels and which are held off the floor by means of two small wheeled carriages near the outer ends. At the outer end of each horizontal member is right-angled or L-shaped framework. The two inner ends of the horizontal members are provided with flat handles pivoted together at their midpoints, so that by closing the handles the telescoping bars are made to overlap more than when the handles are opened.

In the latter instance the ends of the horizontal bars are forced outward so that the L-shaped frames at the ends contact with the front edge of each tire and the front and rear of the wheel rim at the height of the horizontal bars above the floor.

When each L-shaped frame is thus in contact at three points, the parallelism of the two wheels is measured by two pointers, one on top of each of the small wheeled carriages previously mentioned. This is done by introducing a small arm between the pointer and the long arm of the L-shaped member.

If the pointers on each side do not register alike, it indicates that the wheels are out of alinement.

It Keeps Tractors from Overturning

IN the use of light-weight tractors for farm work, difficulty has often been experienced because of the tendency of the tractor to rear up when an obstruction is encountered, as when the plow strikes a root or stump. Unless the power can be shut off instantly, the tractor will probably overturn.

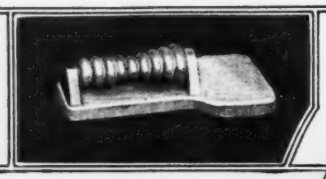
To guard against such accidents, Frank T. Ritter, of Edgerley, Louisiana, has perfected a stopping device that operates the instant the tractor reaches a predetermined angle with respect to the ground over which it is traveling.

A U-shaped member, which may be made from sheet or cast metal, is bolted rigidly to the drawbar of the tractor. A flat plate is secured to a pintle at one end, the opposite end being rigidly secured to the tongue or drawbar of the plow. A bent plate is loosely mounted on the pintle constituting, in fact, a half hinge. The pintle has an elbow and is provided at its end with an upturned portion having a slot. An arm is pivotally mounted by a bolt to the elbow portion of the pintle and extends through the slot, the outer end of the arm being connected to the clutch lever by a chain.

When the tractor is pulling the plow, or other implement, the arm will move up and down in the slot, following the movement of the tractor. When the load becomes too great, as when the plow strikes a root or stump, the tractor moving upward and carrying with it, the clutch-lever brings the arm to the top of the slot thereby releasing the clutch.

When it strikes an obstacle this device stops the tractor

Putting the World on a Right Footing



This corrugated roller (above and left) brings back muscular and bone efficiency. The muscles are exercised and the arch bone throws the toe joints into their proper positions

A flat foot should be rolled regularly, says a Chicago doctor. Four of the rolling-pins he uses are shown in the picture to the left; a fifth is under his patient's foot

Strapping fallen arches brings the muscles and bones back to where they ought to be

With her high-heeled, narrow, pointed pumps, this young lady was a charming sight to see as she walked down the boulevard. Afterward, however, she took off those pumps and relieved the soreness in her feet by resting them on a small electric-light cabinet. Electric light cures many ills

Why Not Beat the Ice Trust with Kerosene?

THE cost of ice to the consumer goes up automatically every summer, and the weather conditions of the preceding winter have little to do with the increase in the price. Yet we must have ice.

A German inventor seems to have solved the problem of making ice on a small scale for domestic use with an inexpensive machine that can be operated and maintained at a trivial cost without experience or mechanical training.

Two cylindrical metal containers, communicating one with the other through one or more pipes, are attached, side by side, to the same horizontal shaft, which may be slowly rotated by hand power or by a small water motor. One of the compartments contains chloride of zinc with a little water. After the air has been exhausted from both compartments they are made airtight and require no further attention.

To start the operation of the ice plant, the heat of a kerosene or alcohol flame is applied to the compartment containing the chloride of zinc. The heat evaporates the water contained in it, and causes the steam to pass to the other compartment, where it is condensed.

Water, a little labor, and the periodic application of a kerosene flame does the rest

During the heating the cylinders are slowly rotated around their common shaft. At this point a double-walled metal hood filled with cold water is placed over the two cylinders and the flame is removed or extinguished. As the mass of zinc chloride becomes cool the condensed steam in the other compartment evaporates, and is absorbed again by the chemical. In this process so much heat is absorbed that the water in the hood becomes rapidly chilled and changed to solid ice, which is taken out and placed in the refrigerator. The operation is then repeated until a sufficient quantity of ice has been obtained.

Only water and a little heat are required. The zinc chloride lasts indefinitely.

A Miniature Lathe that Is Easily Made

By Howard Greene

MUCH of the lathe work done in the course of the average amateur's work is so small that it can be done on a very small tool, and it happens that it is much easier to make such a tool than it is to make a larger one. Moreover, a very small lathe takes up but little room, requires very little power and, altogether, is a desirable thing to have. Without going too much into detail, it will not be difficult to make clear a few fundamentals of instruction that you can apply.

One of the stumbling-blocks is usually the bed. For a small lathe of, say, a 4-in. swing, the bed can be made of a piece of steel shafting ½ in. in diameter. Get a piece of such shafting 2 in. longer than the full length of the required bed, and bend it in the middle, forming a long fork with the tines parallel, as in Fig. 1. Heat the steel before bending, and heat it only at the point where it is to be bent.

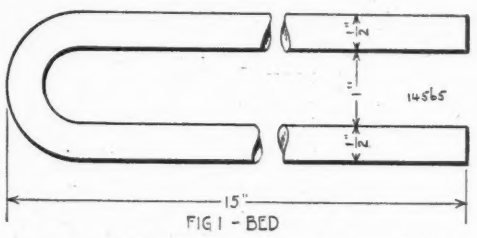


FIG 1 - BED

The shafting is bent to form a long fork with the tines parallel. The steel must be heated at the point where it is bent

Take pains not to bend the straight parts in the least. It is of course practically impossible to get the two legs perfectly parallel at the first bending, but this can be done by degrees when the steel cools. Use a pair of calipers to get the legs parallel. Then lay the bed on a piece of plate-glass or a surface plate and test for twist. Keep testing both ways and bending slightly until the legs are as true as you can get them. A good length for the bed for a 4-in. lathe will be 15-in., for which a 32-in. length of steel will be required. Space the legs 1 in. apart.

Next comes the headstock. Keeping to the same scale, make a plate of cold-rolled steel 3/16 in. thick, 4 in. long, and 1¾ in. wide. In many cases this can be obtained "finished" or bright, and flat and true, and it will only be necessary to cut it to the right length. This is to be secured to the bent end of the bed, and it will make a neater job if one end of the plate is rounded to match the bed end.

Get two pieces of cold-rolled steel—also finished, if possible—¾ in. square and 2 9/16 in. long. Both ends must be carefully squared and true. This is important. It will be a good thing to get the ends trued up in a lathe, if possible, and at the same time have a shoulder turned down on one end of each piece ¼ in. long, forming a round part ⅝ in. in diameter. But the work can be done by hand, and it is not essential that the round part should be perfectly round. The important thing is to have the shoulder perfectly square with the end and ¼ in. from the end all the way round. In the opposite end of each piece drill a ⅝-in. hole with its center 1 13/16 in. from the shoulder. Then drill a ½-in. hole in the center of the end of the piece running into the ⅝-in. hole. Both pieces are to be exactly alike. Fig. 2 shows the headstock details.

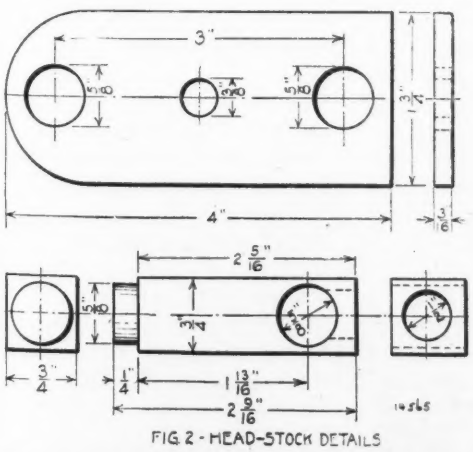


FIG 2 - HEAD-STOCK DETAILS

Here are the headstock details. The steel can be obtained bright, flat, and true, it only being necessary to cut it to the right length

Now drill two ⅝-in. holes in the steel plate with centers spaced 3 in. apart. Thus the centers will be ½ in. from the ends of the plate. They must be exactly in the center line of the plate. Countersink the holes on both sides of the plate—very slightly on the top of the plate—so that the shoulders of the square pieces will fit down snugly, and somewhat more on the bottom. Put the square pieces in place in the plates, and there will be 1/16 in. of the round part projecting through. Rivet over carefully, hammering over the edges with the ball end of a machinist's hammer and using light, sharp blows. It will be best to support the square pieces while riveting by putting through the holes a round rod as large as will go in, resting the rod on the slightly spread jaws of the vise. This will eliminate all danger of buckling the rather thin metal at the sides of the holes. Do the riveting job carefully, for much depends on it.

Midway between the two steel standards drill the plate for a ⅜-in. bolt, which passes through a plate at the bottom of the bed, holding the headstock firmly in position.

To make the tailstock, which is shown in Fig. 3, proceed much as in making the headstock, making the plate of the same material, but only 3½ in. long. Make a pair of posts of square steel as before and rivet them into the short plate, spacing the holes each ⅜ in. from the ends of the plate, so the posts will be flush with the ends when in place. Leave one of the posts 3/16 in. longer than the other at the top, above the hole, and do not drill either of the tail-stock posts from the top. Drill for a bolt between the posts, as in the case of the headstock.

Now get a piece of steel shafting that will just fit in the ⅝-in. holes in the four posts. A piece 1 ft. long will do. With headstock and tailstock in place, but loose so they can be moved, run the shaft through all four posts, thus holding them in line. With calipers get the shaft as nearly as possible true with the bed. Then tighten the two bolts, holding head and tailstocks firmly in place.

Turn the whole affair on end, tailstock up, and pour melted babbitt into the space under the headstock, holding the metal in by clay luting, sheet asbestos or any convenient way. This sets the headstock permanently in place. When the metal is set, turn the lathe upside down and pour babbitt in under the tailstock, blocking at each end of the plate. Fill up to within ⅛ in. of the thickness of the bed bars.

As the idea is to hold the headstock immovable, it will help matters to

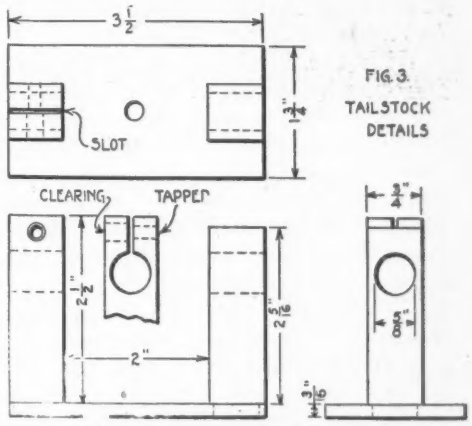
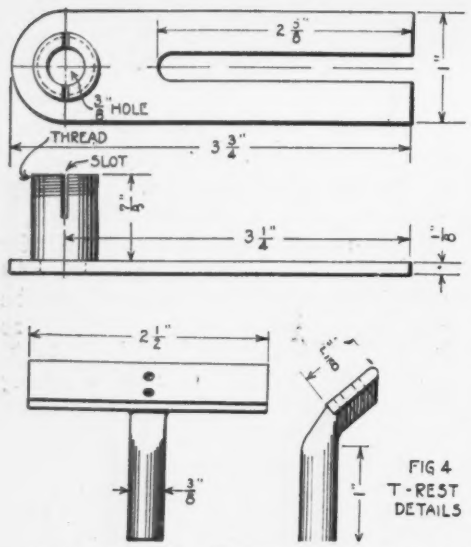


FIG. 3. TAILSTOCK DETAILS

The long post of the tailstock can be split with a hacksaw at the top as shown herewith

rough up the plate and the bars where they will be covered with babbitt by using a rough file, or making a great many center-punch marks; or, better yet, by drilling a number of ⅛-in. holes to a slight depth, say ⅛ in.

In the case of the tailstock, you must drill the bottom of the plate, making as many holes as you have patience to drill. Do not drill straight, but at all sorts of angles, and do not let the drill go through. This will ensure the babbitt sticking fast to the plate. It must not stick to the bars, however, which should be heavily smoked with a candle, so that they will be coated with black soot. Take pains to see that there is soot on the bed bars wherever the babbitt will touch, but none on the plate. Now you will have a tailstock that will



The T-rest is made from cold-rolled steel and one end is rounded in a semicircle

slide easily along the bed, and the way it slides will be a test of the care taken in making the legs parallel and true. Instead of a nut on the lower end of the tailstock bolt, use a thumbscrew, so that a wrench will be unnecessary. The piece of shafting can be removed from the holes, for its work is finished.

For the spindles in both headstock and tailstock use steel shafting, and select it very carefully, for this material is sometimes defective. It should be ⅜ in. in diameter. Better yet, get a piece of tool-steel drill-rod of the kind that is straight and round. Get a piece at least a foot long.

With the headstock and tailstock at opposite ends of the bed, and the tailstock clamped down, pass the steel rod through all four holes, as was done with the ⅝-in. shaft, and hold them in position with two pieces of wood, drilled to fit the rod tightly, clamped to the outer sides of the posts at the extreme ends.

Now adjust the rod until it is true with the bed, and this means the most painstaking work you can do. At the same time have the rod as nearly as possible centered in the holes in the posts. Don't skimp on time or trouble in this job. Then clamp the wood pieces so the rod cannot move, block up around the rod in the headstock posts with putty or clay and pour full of babbitt through the top holes. Before pouring, heat posts and shaft as hot as possible without burning the wood. Smoke the rod so the babbitt will not stick to it. Then babbitt around the tailstock end of the rod, filling both holes. To do this, turn the lathe on end, headstock up, and pour into the ends of the holes. As there is already a wood piece blocking one hole, it will be necessary only to block one end of the other hole.

When the babbitt is cold, take out the rod, remove the luting, etc., and trim up all rough places. Drill oil-holes through the tops of the headstock posts with a ⅛-in. drill. The headstock spindle will be a piece of the rod projecting ¾ in. on either side of the posts; the projection at the rear is useful for mounting small grinding and buffing wheels and the like. Use one, two or three small grooved pullies, which are best purchased ready made and do not cost much. Prevent end motion of the shaft by putting a collar on it so it will bear against the inside of the back post.

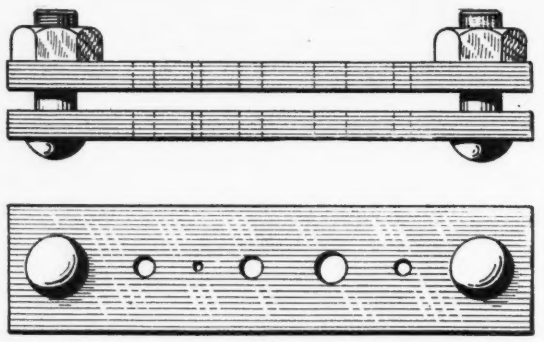
The long post of the tailstock, which, by the way, must be placed at the end of the plate nearest the headstock, is to be split with a hacksaw from the top, as shown in Fig. 3. Then drill and tap, as shown in the drawing, for a ¼-in. screw and drill the head for a ⅛-in. bar. This serves as a "pinch" to hold the spindle wherever desired.

The tailstock spindle is moved back and forth by means of a lever pivoted to a link which, in turn, is pivoted on a 3/16-in. screw tapped into the left post of the tailstock. The illustration makes this sufficiently clear.

Make a point on the end of the tailstock spindle by putting it in the place of the headstock spindle after the lathe is otherwise finished, and turning it down with a hand tool. If the spindle is of drill rod, the point should be hardened and tempered to a medium straw-color. Drill the headstock spindle for centers, using a 3/16-in. drill and tapering the hole with a taper reamer. This hole must be truly central. The back end of the drill should be held against the tailstock spindle while drilling. If desired the tailstock spindle can be treated in the same way, and it will be a great improvement, as any kind of center can be made and used.

The last job is the T-rest, Fig. 4. For the foot use a piece of cold-rolled steel 3¾ in. long, 1 in. wide and ⅛ in. thick. Round one end to a semicircle. Cut a slot 2⅝ in. long from the other end, wide enough to take the squared part of a quarter-inch carriage-bolt. At the rounded end center and drill a ½-in. hole and countersink both sides slightly. Get a ⅝-in. finished bolt with hexagon nut. Screw the nut as far as it will go down on the thread and saw the bolt off flush with the top of the nut. Cut off to a length of 1 1/16 in. Square the end opposite the threaded end accurately, shoulder it to fit the half-inch hole in the foot-plate and rivet it in precisely as you did the headstock and tailstock posts. Drill a ⅜-in. hole clear through the piece of bolt lengthwise, and be very careful to center the hole accurately and have the bolt perfectly vertical while being drilled. Split the hollow post with a hacksaw, running the cut ¼ in. below the thread.

Cut a piece of ⅜-in. steel rod 2 in. long and bend ½ in. at one end to an angle of about 40 degrees. File the bent part, on the outside of the bend, to form a flat 5/16 in. across, and to this rivet, with two ⅛-in. iron rivets a piece of ½ x ⅛ in. cold-rolled steel of the length desired for the rest. It will be well to make, say, three of these fittings with the rests of various lengths—say 1 in., 2½ in. and 5 in.



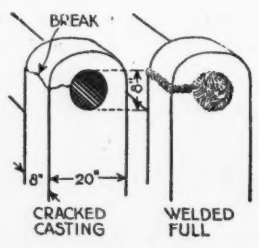
Be careful to center these holes and have the bolts fit vertically while they are being drilled

The ⅜-in. rod will just fit in the hole in the post, and screwing the nut down to the end of the thread will clamp it in position. The lower end of the carriage-bolt that goes in the slot in the foot-plate passes through a plate of 1/16-in. steel large enough to rest on the under side of the bed legs.

How a Heavy Casting Was Welded

By Donald A. Hampson

THE sketch illustrates a steel casting that broke under the stress of a hundred tons. The break extended from the hole outward, on one side only. It was thermite welded in the usual manner, but it cracked in the same place in a few weeks, the reason assigned being the uneven heat and consequent greater contraction on one side. The second time i was welded the hole was filled up, solid, and the crack was also welded. To fill the hole, it was necessary to heat all around it to the same temperature, which meant that the contraction would be even. The proof of the correctness of this theory was the service of years under a greater load than before.



How a broken steel casting was made whole by an ingenious welding

In the large manufacturing plants and even the small machine-shops there are pieces of broken machinery thrown away that could easily be made as good as new by welding. To machine new parts for a complicated lathe, or the like, costs money these days, yet the manufacturer hesitates to install a welding apparatus.

If— I had only put on— WEED TIRE CHAINS

Regrets avail nothing when the harm is done.

Many an accident might have been avoided and many a life saved if drivers of automobiles had only exercised ordinary, everyday precaution and had listened to the warnings which for years have been sounded through the magazines and daily newspapers, viz.—,"Always put on Weed Tire Chains when the roads and pavements are wet and slippery."

It's all very well to say, "I'm sorry—I didn't mean to do it."

Regrets don't mend broken limbs or bring back the lives that have been taken. The innocent victims have suffered through no fault of their own while the careless motorist escapes with a reprimand, the payment of Doctor's bills and the expense of having his car repaired. Is there no way to make such fellows realize their responsibility and have ***more regard for the rights of others?***

In the interest of humanity—in the interest of safe and sane motoring Put on your Weed Tire Chains"at the first drop of rain," and insist that others do the same.

Skidding accidents would never occur if every motorist exercised care in driving and put on Weed Tire Chains whenever roads and pavements were wet and slippery or covered with mud and slime.

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Taking Flashlights by Electricity

A method by which indoor photography may be accomplished without the aid of flashlight powder or paper

By Theron P. Foote

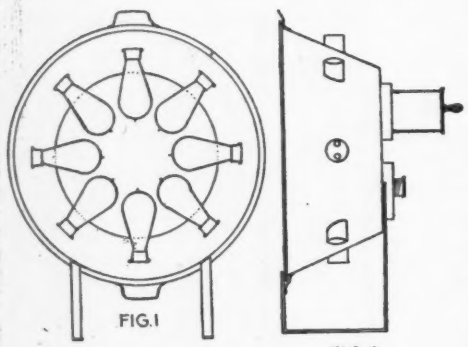
DURING the war, law forbade the manufacture and sale of powder for flashlight purposes. Accordingly it was almost impossible to find a dealer who had any back stock on hand and even if such a stock were found, its price was apt to be beyond the amateur photographer's pecuniary limitations.

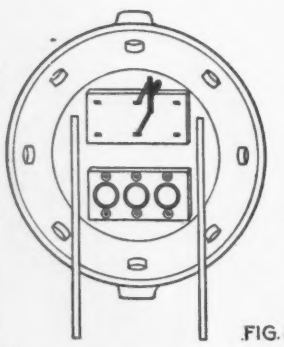
One ingenious lad who was an amateur but who did occasional portrait work professionally, would not let the inconveniences of war disturb his work.

As the lens of his camera was of slow speed and most of his work was interior portraiture it was absolutely necessary to obtain some means of artificial light. He procured a large dishpan, marked the center line around the side and divided it into eight equal parts. At each point he drilled and filed out a hole large enough to accommodate a standard, Edison base sign receptacle.

Two pieces of ¾ in. by ⅛ in. band iron, each approximately 2 ft. long, were bent and soldered to the pan for a standard. See illustration Figure 1, which shows the front view of the apparatus and Figure 2, which shows the side view.

On the back and bottom of the pan was mounted a three wire Edison base

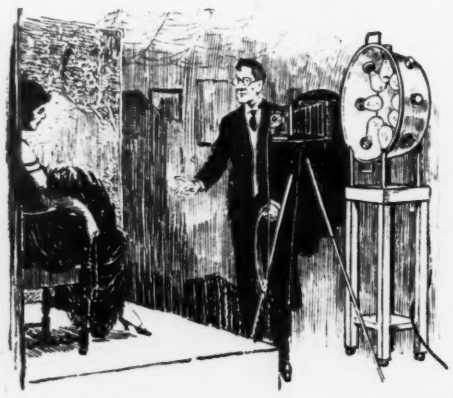




Figures 1, 2, and 3 show the front, side and back views of the machine. There is nothing complicated about it

fuse receptacle with ten ampere plug fuses installed. Over this was mounted a double pole double throw switch. See Figure 3.

The wiring connections are shown in Figures 4 and 5, the first showing the direct method of connection while the second shows the simplified or developed wiring of the same. A pear



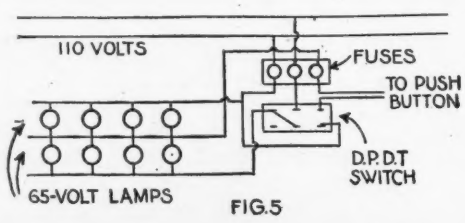
The illustration shows how the apparatus will appear when the photographer is ready to take the picture. There is no danger in using the device

push button mounted on the end of a 10 or 12 ft. extension cord connects to one terminal on the fuse block and one terminal on the switch. Another 10 or 12 ft. extension cord having an attachment plug mounted on one end connects with the fuse block and supplies the current from the city circuit.

If the city circuit in your locality is approximately 110 volts, eight 65 volt lamps, each of approximately 60 watts, should be placed in the sign receptacles.

Setting the apparatus in place a little to one side and a trifle back of the camera the attachment plug is connected to the city circuit and the double pole double throw switch is thrown to the left. This connects every two lamps in series and the four sets of two in parrallel, or requires about (65+65=) 130 volts to bring to full candle power. On a 110 volt circuit they will burn a little below full candle power. This will give sufficient light for the correct focusing of the camera.

Now reverse the double throw switch, throwing it to the right. With the plate or film loaded in the camera, the push button in one hand, open the shutter with the other, press the button for a duration of less than one second and 110 volts will flow through each 65 volt lamp. From experimental tests it has been found



If the city current is approximately 110 volts eight 65 volt lamps should be placed in the receptacles

that when double the normal voltage is applied to a lamp the result is approximately seventeen times the normal candlepower.

This intensive illuminating materially shortens the life of the lamp so that a lamp on double voltage will last on the average only two minutes, provided the current flows constantly. The short life is due to the excessive temperature.

When the push button is pressed for only a second or fraction thereof the lamp rarely reaches a maximum point of temperature, therefore it will give a life of more than 120 flashes.

As the up-to-date lamp gives a little better than one candlepower per watt, in normal burning the eight lamps should give (8 + 60=) 480 candlepower. As only 110 volts instead of 130 volts is thrown across each 65 volt lamp, we will assume that the lamp gives fifteen, instead of seventeen, times the normal candlepower, or (480 + 15=) 7200 candlepower. This candlepower, although perhaps not equal to a large powder flash, will greatly aid in the taking of

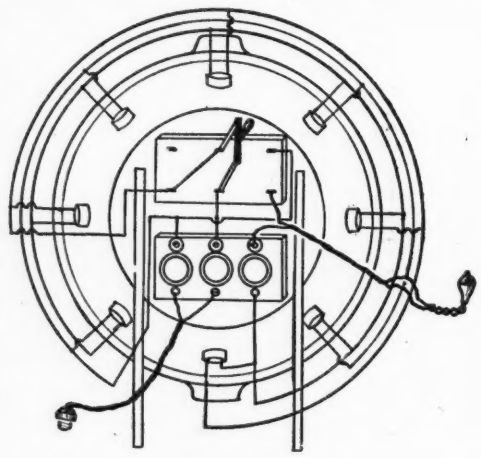


Figure 4 shows the direct method of connection with the house current

interior photographs and successful work has been accomplished with the aid of this scheme.

When the amateur is confronted with the need of making a picture of an object in which the detail is very fine, he may find the ordinary focusing methods not sufficiently exact. At a slight expense, a camera with a ground glass focusing arrangement can be equipped with a superior focusing screen.

Take an unexposed plate, and expose it for one second in the dark room to a candle at a distance about 10 ft. Developing and fixing it in the usual way will yield a plate with a slight tint of gray. This will be found much better than the screen now in use.

"Without research no scientific discoveries or inventions have been made."
ENCYCLOPÆDIA BRITANNICA

MORE than a decade ago Mazda Service took form in the Research Laboratories of the General Electric Company. Chemists, physicists, metallurgists and engineers, coordinating and cooperating in a steady forward drive for scientific knowledge, have built the fountainhead of experience and technical skill from which Mazda Service flows. The laboratories that house it are without counterpart in the world.

Mazda Service has made possible many things. Its outstanding achievement is the Mazda lamp. The modern X-ray tube, powerful, adaptable and reliable, is another result of the search of these men for the perfect incandescent electric lamp, and the study of the thermionic emission of its filament. This is one example of the far-reaching influence of Mazda Service.

What part this influence played in the use of electricity in the war; what it has contributed to wireless communication, through the improved vacuum tube; to surgery, in X-ray development; to the art of lighting, with electric lamps as large as melons and as small as peas; to industry and commerce, to the progress and comfort and health of humanity, is a story that has not been told.

Because it has entered deeply into everyday life, because the benefits it has brought are universal, the story of Mazda Service is worth telling, and worth hearing.

RESEARCH LABORATORIES OF GENERAL ELECTRIC COMPANY

MAZDA

Make Big Profits Repairing Tires

DO you want more money? Do you want to get into a fast-growing, uncrowded business where you can make from $250 to $500 a month the first year? Do you want to be independent? Do you want to share the profits in the richest industry in all America?

Of course, you do. Then investigate the tire repair business—and do it now. The Jim Dandy Tire Repair Plant is making money for many men. It can do it for you.

Fortunes have been made in all lines connected with the automobile industry—but none has ever offered greater opportunity than tire repairing with a Jim Dandy Plant offers you today. The tire repair men of America have a $200,000,000 business ahead of them this year. Think of it!

By January 1st, 1921, there will be 40,921,076 tires in use in this country. Every one of these tires must be repaired some time. More tire repair shops are needed. Big, profitable business is waiting for them. Do you want it?

Business is Going Begging

This is your opportunity. The tire repair industry needs business men of ambition and ability. The field is uncrowded—the number of tires to be repaired is increasing at the rate of 40% a year.

As proprietor of your own tire repair establishment you will be dealing with the wealthiest and most prominent people in your community. These people will ask you for advice about tires, accessories, even automobiles—unlimited opportunities for profit will be yours.

And you will be in a business which is an absolute necessity to the community. Tire repair trade comes again and again. You will have a steady repeat business getting bigger and bigger every year.

$250 to $500 a Month

With your own Jim Dandy Tire Repair establishment you can make your income $250 to $500 a month or more depending on your energy and initiative. Many tire repair men who have done a business of $250 the first month have increased to $500 the third month. What these men have done you can do. They started like you and learned the business. Their success is not unusual.

Get started in tire repairing with a Jim Dandy plant and get started now. There will never be a better time to start.

Own Your Own Business-Be Independent

WHY depend on another man's business to make a substantial income for you? Why not put your time and ability into your own tire repair business—then you will get all you earn. ***You*** can be independent just as well as the other men who own Jim Dandy Tire Repair Establishments. These men broke out of the rut, stopped working for somebody else—and started their own tire repair establishments.

We Teach You FREE

You can start a highly profitable business today with a few hundred dollars. One Jim Dandy Plant equips you—we teach you everything about tire repairing—how to start in business—how to get trade—what to charge—how to figure your cash profits. You can learn in one to three weeks—and be ready to make money.

It makes no difference what your present business is. You can make a success of your own tire repair establishment. You don't have to be a mechanic. Neither do you require a college education. Tire repairing is a business man's business. If you have the energy and the will to do, we can teach you in a short time.

We have had forty-one years successful business experience. Since 1879 we have been gathering the information and experience which help you make a quick start today. You understand, of course, that we give you our training and help without charge.

The men who have made big money are the men who have had the foresight and the nerve to break away from the crowd and strike out for themselves when they saw a chance for independence. Don't let a salaried position keep you from ***your*** chance to own your own business, be your own master, pocket your own profits. Many a "job" has kept a man from a bigger opportunity as an executive in his own business.

Your Opportunity

Haven't you often felt that ***you*** could manage the business you are in now, if you had the training and opportunity? Haven't you suggestions and ideas which you know would make bigger profits possible? Give yourself a chance to use these ideas where they will pay ***you***.

In your ***own*** tire repair business ***you*** will have a chance to do the planning and give the instructions. In a short time you can have more work than you can do alone. Then you will have assistants to do the actual work, while you give your time and thought to the active management.

No previous training—no long apprenticeship—no large investment. You can get started immediately—open a shop—and in a short time you have more work than you can handle alone. Good tire repair men are badly needed. Your profits start the day you set up your Jim Dandy Plant.

There is no city too large or town too small for you to do a profitable tire repair business. To every 11 persons in the United States there is an automobile with four tires to be repaired. No matter where you are—what your age or occupation—in ***one month from today*** you can be making money from your own tire repair business if you start ***now***. Let us prove it.

A Jim Dandy Tire Repair Plant makes it easy for you to learn the business and to turn out the kind of work that brings customers back again and again. It is the only tire repair plant on the market which uses superheated steam. Perfect work is assured even when you are a beginner. You can make any kind of a repair—and you buy no unnecessary molds or parts. You do not pay for anything that will not bring returns.

The Jim Dandy has the largest capacity of any plant of its size on the market. It is fully guaranteed and backed by our long experience in the tire repair business. We have established tire repair businesses for men of many ages and professions in towns of 200 population and up and have no record of a failure. We are ready to give you every assistance.

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Investigate. Send the coupon below or a letter or postcard. This brings you full information—personal consideration and advice—and a big catalog. Tells all about the tire repair business. How you can make money—be independent.

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Gentlemen: Please send full information about how I can start in the tire business with small capital and make a good income. Also your FREE book entitled, "Your Opportunity."

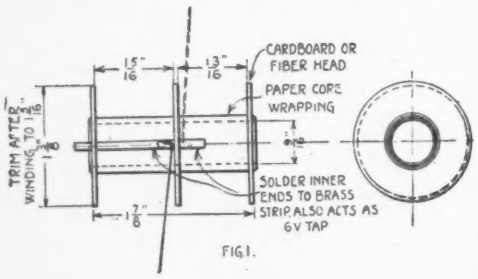
Name .....

Address .....

How to Make a Two-Step Night-Light Transformer

By H. H. Parker

THE miniature transformer illustrated herewith is intended to operate on the regular 110-volt, 60-cycle house circuit and may be screwed into any lamp-socket, taking up about as much space as a regular 25-watt globe. It will light one 6-volt 2-candlepower miniature screw-base bulb or one 2.8-volt flashlight bulb; the 6-volt size is preferable, for it may be dimmed on the 3-volt tap, yet will furnish plenty of light for use as a night lamp and can be instantly turned up if desired, a convenience not found on the commercial devices of this character.



Ten layers of shellacked paper are wrapped over the paper core as shown in Fig. 1

It is of the open-core type and connected as an auto-transformer, that is, no separate secondary coil is used (Fig. 7). This makes an exceedingly small and compact arrangement for the purpose, though not exactly suitable for bell-ringing, where a closed magnetic circuit would be better, in order to cut down the core loss, and where a secondary coil entirely separate from the service mains would be desirable. The construction is simple, as the following specifications will show:

CORE: Wrap about 10 layers of shellacked paper around a rod 9/16 in. in diameter and glue the edges. Make this cylinder 1⅞ in. long. When the winding is completed, fill this with straight soft iron wires, about No. 18 or 20 gage, 1⅞ in. long, then file off flush with spool faces.

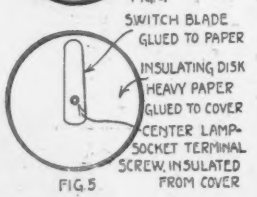
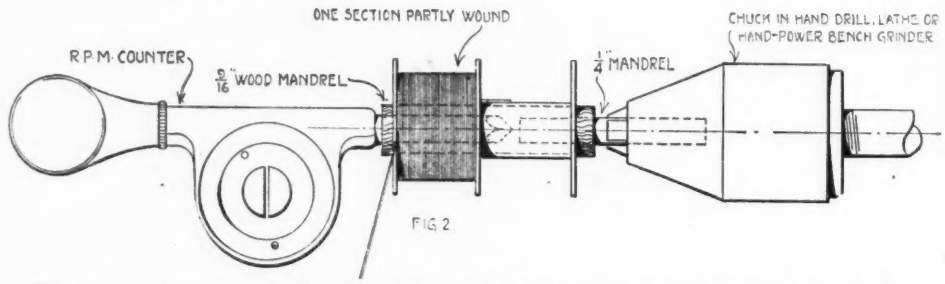

SWITCH BLADE GLUED TO PAPER
INSULATING DISK
HEAVY PAPER GLUED TO COVER
CENTER LAMP-SOCKET TERMINAL SCREW, INSULATED FROM COVER
FIG.5

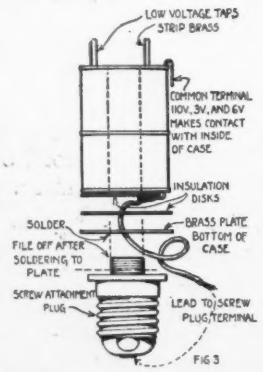
Fig. 4. How the taps are bent over on the paper. Fig. 5. The brass strip is glued to inside paper disk

SPOOL: Cut out three heavy cardboard disks about 1⅜ in. in diameter, with center hole to allow them to slip tightly over paper core described above. Glue into place at distances shown in Fig. 1. Slip a short strip of thin brass under center and projecting beyond end disk of longer section. This forms a center connection for the section windings as well as the 6-volt tap.



The revolution counter is placed at the end of the coil and the number of wire windings counted with it. A hand drill will spin the coil so that the work may be uniformly done

WINDING JIG: The coil may be wound in a crude wooden rig, a lathe if at hand, a breast or hand drill clamped in a vise, or by removing the wheel from a small hand-grinder and screwing a hardwood bush over the spindle end. This arrangement is about as satisfactory as any. If a revolution-per-minute counter can be obtained, attach to other end of the mandrel, as in Fig. 2, to count the turns; otherwise a little experimenting will be necessary to find the right tapping points.


LOW VOLTAGE TAPS STRIP BRASS
COMMON TERMINAL 110V., 3V., AND 6V MAKES CONTACT WITH INSIDE OF CASE
INSULATION DISKS
SOLDER
FILE OFF AFTER SOLDERING TO PLATE
BRASS PLATE BOTTOM OF CASE
SCREW ATTACHMENT PLUG
LEAD TO SCREW PLUG TERMINAL
FIG 3

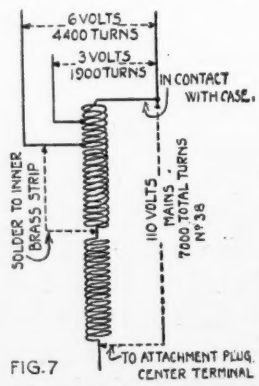
Wind on the remainder of the wire and test the coil again to make sure

WINDING: About three ounces of No. 38 enameled wire is necessary. To save space no insulation is used between layers. Coil is in two sections, both inside ends being soldered to the brass strip, which is then paper insulated. Wind sections in opposite directions. This method brings both finishing ends on the outside and does away with the fragile and poorly insulated inside end otherwise used. If the revolution-per-minute counter is at hand, wind on 2600 turns on the longer section and bring out a paper-insulated brass strip soldered on, as the 3-volt tap (the inner strip serves as the 6-volt tap); then complete the section with 4400 turns total. Put 2600 on the narrower section (13/16 in. long), making 7000 turns in all. Then remove from mandrel, slip in a ½-in. temporary iron core, and test out. If the number of turns cannot be counted, wind the short section full to about 1 5/16 in. in diameter. Wind the other section a little less than half full, bring out a tap, complete the coil and test. If not right, unwind the longer coil and tap at another point. More turns if lamp is not bright enough. Wind on the remainder of the wire and test again.

The transformer as it will appear when finished. Make sure that all parts are well insulated and that all the contacts are tight

Solder wire ends to brass strips (Fig. 3), insulate them and glue into place and wrap the whole coil in paper.

CONTAINER: A brass case is best; either a length of 1⅜-in. olive drab tubing or preferably a cylindrical box with friction cover such as paper fasteners and similar office supplies used to be sold in. Cut off lower end to make suitable length. Cut a sheet-brass disk to fit bottom and drill out to take the brass screw inner sleeve of a screw attachment plug. Solder this plug to the disk, file off the end of the sleeve and cement the screw-base sleeve to the bottom to prevent its turning. Solder a short flexible lead to the bottom coil terminal (short section), thread it through bottom disk with a heavy paper or fiber insulating disk at each side (Fig. 3), and when bottom is soldered to case, insert coil and attach wire to the bottom center terminal of the plug. The upper coil terminal is bent over to make contact with the case inside. Make sure that the lower coil terminal is well insulated from the brass case.


6 VOLTS 4400 TURNS
3 VOLTS 1900 TURNS
IN CONTACT WITH CASE.
SOLDER TO INNER BRASS STRIP
110 VOLTS MAINS - 7000 TOTAL TURNS N° 38
TO ATTACHMENT PLUG CENTER TERMINAL
FIG.7

Here is the wiring diagram of the auto-transformer. No secondary coil is used

COVER: Remove the inner screw sleeve from a miniature porcelain socket and solder it to the cover. Glue a heavy paper disk inside the cover, drill a 3/16-in. hole through the center and insert the small center screw. Glue a brass strip to the inside paper disk (Fig. 5), and tap it for this screw. Make sure this center terminal is insulated from the cover. Slip another paper disk over the top coil terminals (Fig. 4), and bend them over so that the center cover strip will contact with them.

Blue Buckle Union Made OverAlls

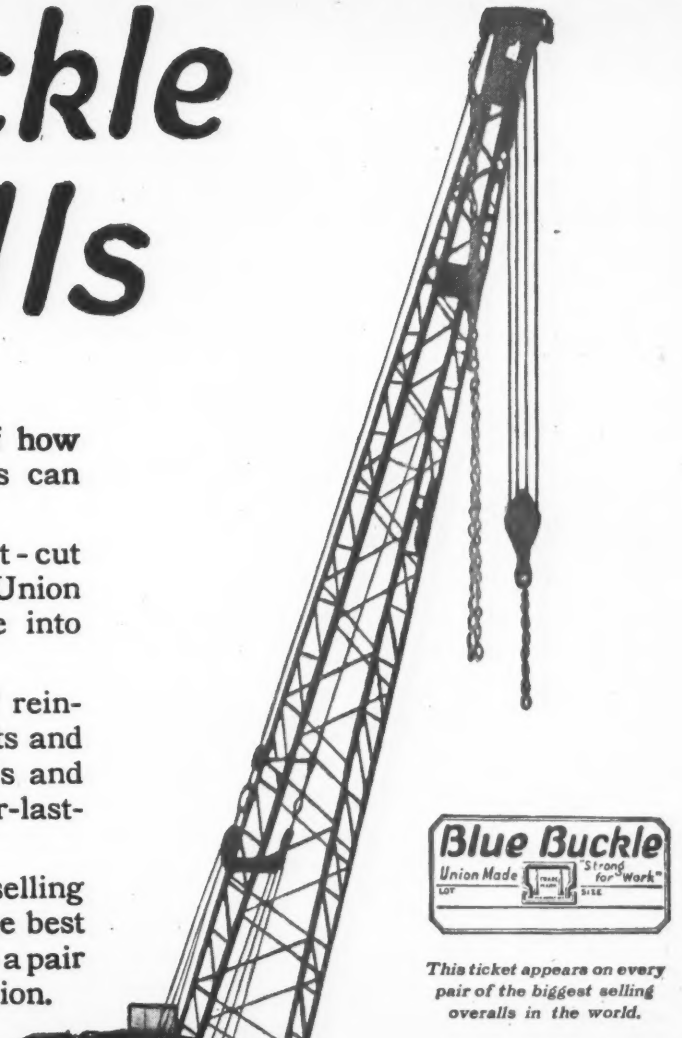
"Strong for Work"

Blue Buckles give men a new idea of how much comfort and wear-service overalls can hand out.

From the generously roomy comfort-cut down to the last detail of finishing, skilled Union workers put the most painstaking care into Blue Buckles.

Exceptional features like Blue Buckles' reinforced back band, tack-stitching on pockets and seams, and carefully inspected materials and workmanship save you money in a longer-lasting work garment.

Blue Buckles are America's biggest selling overalls—the choice of men who want the best because they are most economical. Get into a pair for your own comfort and service satisfaction.



This ticket appears on every pair of the biggest selling overalls in the world.

Ask your dealer for Blue Buckles

Jobbers OverAll Co., Inc.
Lynchburg, Virginia

Largest Manufacturers of Overalls in the World

Dual Protectors Of the American Home

WHAT home would be without the beneficent insurance policy which restores and repairs after loss and damage?

Without insurance those catastrophes, beyond the power of individuals to prevent, would be complete. And we companion this insurance with the protection of a COLT to thwart harmful and evil influences which, unless prevented, lead to catastrophe.

Thus—the stealthy shadow of the auto thief, seen from your bedroom window at your garage door, vanishes into the night when you challenge him with a COLT.

The sneaking figure of the fire-bug who, with vengeance in his heart for a fancied wrong, means to make a ruin of your home or factory when surprised, surrenders when confronted with a COLT.

The night prowler caught upon your veranda has no other thought but flight, instead of the savage rush he premeditated, when he comes face to face with a COLT.

Instead of battling the futile resistance of empty hands, the bold hold-up man who has stopped your car on the lonely highway becomes a shrinking coward when he finds you argue with a COLT!

And so we have the dual protectors of American homes, the insurance policy which provides a recompense for those losses which could not be helped, and a COLT Automatic Pistol or COLT Revolver which reduces to a minimum the unpreventable danger.

When you buy a COLT remember that you are getting "The Best that Money can Buy." Nothing else should satisfy.

Drop in and talk it over with your dealer

COLT'S PATENT FIREARMS MFG. CO.
HARTFORD, CONN.

COLT'S

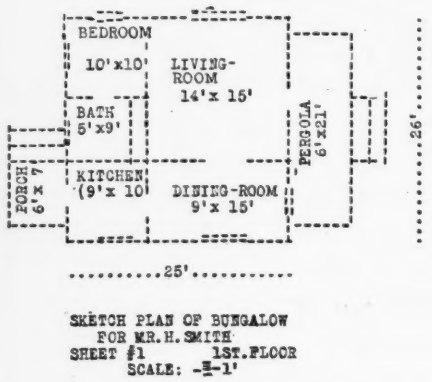
Manufacturers of
Colt's Revolvers
Colt's (Browning) Automatic Machine Guns
Colt's Automatic Pistols
Colt's (Browning) Automatic Machine Rifles

FIRE ARMS
"The Best that Money Can Buy"

Plans Quickly Drawn to Scale on a Typewriter

HERE is illustrated a practical method of drawing rough-scale plans on a typewriter and without the use of a single instrument.

Even if this way of making a sketch plan took longer than doing it on a drawing-board, there would still be much to commend it. In the first place, a board and drawing-instruments are not always at hand, while



Make your house-plans on a typewriter. You will find they easily come to scale and are quickly produced; several copies can be made at a time

not even a scale or rule is needed to draw the plan on the typewriter. Second, as will be seen, the plan is neat, clean, and clear. Finally, there is the very considerable advantage that several copies can be instantly made at once and without any extra work whatsoever.

These points would frequently warrant the expenditure of a little extra time on doing the plans in this manner, but they can, as a matter of fact, be drawn as quickly on the machine as they can by hand, and sometimes even more rapidly.

The fact that the typewriter automatically produces equal spaces makes it easy to figure the sizes of the various walls and partitions and to properly place doors and windows. It is true that sizes of less than one foot cannot be readily indicated graphically in this manner, but this is of little importance, as no sketch plan is supposed to be accurate, and exact sizes are indicated by the figures anyway.

A little practice will enable any one familiar with a typewriter to get out such plans very rapidly. Of course a visible writing-machine must be used. The lower wall (the one nearest the bottom of the sheet) should be drawn first, then the right-hand wall. Windows should be indicated by the double dash, distance lines by dots, doors by spaces, as indicated.—HENRY SIMON.

Cast Lead Laps for Truing Crankshafts

IF an engine crankshaft is slightly scored or scratched, it may be polished up by means of a lead lap charged with oil and fine abrasive

Refrigeration and *Tycos*

IN ancient times a Roman gentleman tired of drinking warm wine. So he experimented.

Placing a bottle of wine in another vessel containing water, he threw some saltpeter slowly into the water, at the same time rapidly rotating the bottle. Result—a cold, refreshing drink.

And it is said that the natives of India at even more remote periods were familiar with this method of reducing temperature. From such simple experiments refrigeration developed. Today, though the thermometer soar upward, fresh meat, vegetables, and other necessities and delicacies of life, are shunted here and there across the earth in perfect safety, thanks to the development of temperature indicating, recording, and controlling instruments. For in refrigeration temperature control goes to the very root of civilization. Without temperature indicating, recording, and controlling instruments there could be no cold storage and refrigeration. Without refrigeration the world would go back to the dark ages and every man would have to produce his own supply of perishable food.

In thousands of ice making and refrigerating plants, where ice for home and commercial use is made and countless tons of food, furs, and other articles are stored, *Tycos* Temperature Instruments are used. And in this as in hundreds of other industries, the name *Tycos* stands for dependable accuracy.

Tycos Wall Thermometers
To help you maintain a temperature in your house conducive to good health.

Tycos Bath Thermometers
To enable you to get the most good from your bath.

Taylor Home Set
Bake Oven Thermometer. Candy Thermometer. Sugar Meter. The secret of accurate results in cooking.

Tycos Hygrometer
To enable you to keep the humidity of the atmosphere in your home correct at all times.

Tycos Weather Barometers
Forecast the weather twenty-four hours ahead with dependable accuracy.

Taylor Quality Compasses
To show you the right way in unfamiliar country.

Tycos Fever Thermometers
A necessity in every home.

Tycos Office Thermometers
An aid in promoting business efficiency.

(Ask Your Dealer)

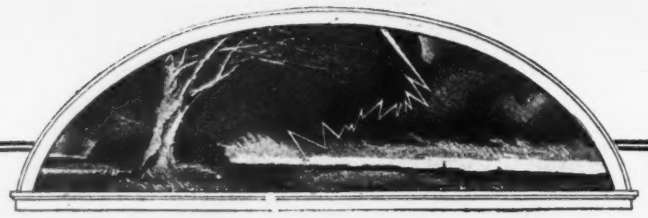
There are over 8,000 different types and styles of instruments in the *Tycos* line. At the left we list *Tycos* instruments for home use. Ask your dealer about them. If he won't supply you, write direct to us sending dealer's name. Literature on any instrument or type of instruments in which you are interested will be mailed promptly.

Taylor Instrument Companies

Rochester, N. Y.

There's a Tycos and Taylor Thermometer for every purpose

(x-6)



Crack o' doom any day in the year

Midday—the sky suddenly overcast—a storm breaks in darkened fury—click, click go the electric switches all over town—lights twinkle cheerily in office, shop and home.

A scenario you'll recognize. It's being played somewhere every day. The storm is the villain, threatening inconvenience and danger, while in the nick of time the Electric Light Company steps in and saves the day.

But it is not by chance that this public servant can take care of the abrupt daytime demand, rising in a few minutes from almost nothing to full capacity. Such an emergency was anticipated in the very design and construction of your Electric Light Company's plant.

There are boilers specially devised to meet sudden calls for steam—stations interconnected by a network of wires, so that one can help another—generators built at great cost to carry an overload for hours.

Meanwhile to report the approach of trouble, the Electric Light Company keeps in constant touch with the weather bureau and maintains its own lookout.

Thus there is ample warning to stir the fires into new life and to bring extra generators and transmission lines into action, so that we may have light when and where and how we want it.

But if the engineers did not make ready before the actual need, a storm would be a time of darkness and fear. The stoppage of business might prove the least of the harm resulting.

Or if, on the other hand, the method of being prepared was to keep the entire plant going at full blast at all times without regard to demand, the waste in operation would lead to increased costs and ultimately to increased rates.

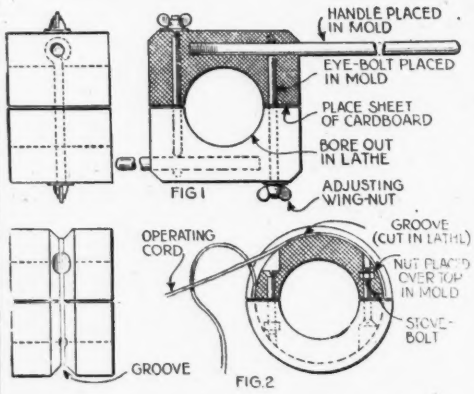
It is by applying economy to the solution of emergency demand that the central station protects the subscriber's dollar at the same time that it safeguards his service.

Published in the interest of Electrical Development by an Institution that will be helped by whatever helps the Industry.

Western Electric Company

No. 17 *Visualize a catalog seven inches by ten, with each of its 1100 pages devoted to listings and information on electrical devices and materials. This will give you some idea of the many-sided activity of this Company in serving the public's electrical needs.*

powder. The illustration shows two simple forms of cast laps. Fig. 1 shows the ordinary form operated by means of two handles. This is cast in a wooden mold. The mold is built up of dry lumber and should be well constructed so that it may be used for recasting the lap when worn out. Holes are drilled for the handles and the adjusting eye-bolts and these are pushed through into place before running the lead into the mold. A round wooden block is screwed in the center



This is an easy way to polish an engine crank-shaft that is slightly scored

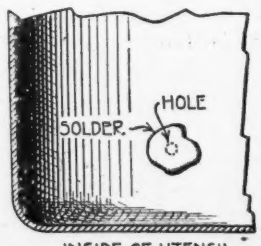
and two sheets of cardboard are put in place, dividing the mold in two, the lap being made in two parts to allow for adjustment and for placing over the crankpins. A coarse thread is cut on the inner ends of the handles to assist holding them in the lead.

After the lead is poured and cool, the mold is taken apart and the handles removed. Then the lap is placed in the lathe and bored out to fit the bearings, when it is ready for use.

Fig. 2 shows a lap of similar construction except that it is cylindrical in shape and has a groove turned in it around which a heavy cord is wound and the lap is rotated by pulling the cord back and forth. This allows of a higher rotative speed than the handles of Fig. 1, and hence faster grinding. The bolts must be set deep enough not to interfere with cutting the groove.

A Quick Way to Mend Granite Ware

GRANITE ware pots and pans that have sprung leaks can be mended by the simple process of cleaning the metal around the hole and soldering in the ordinary way. If necessary scrape or chip away a little of the lining to get clean edges. Flow the solder all over the exposed metal, right up to the lining. Spots where the lining has come off, leaving the metal exposed, can be tinned in the same way and the utensil's life lengthened.



A good way to mend a granite or enamel ware kitchen utensil

KOPF'S TRIPLE PUTS REDS IN EARLY LEAD

Sallee Outpitches Williams at Start of Second Re
Game—Roush Robs Felsch of a
Home Run.

SCORE BY INNINGS.

REDLAND FIELD, CINCINNATI, Oct. 2.—Continuing
their assault upon the White Sox pitchers, the Reds crashed
through to another victory to-day, winning the second game
of the world's series. The big stands, jammed to the rails
with a roaring, surging mass of fans, presented a wonderful
scene as the Reds sent their powerful opponents down to
another defeat. The game was played under a cloudless
autumn sky, and the ideal weather, coupled with the Reds'
second victory, served to make the day a perfect one for
Redland fandom.

FIRST INNING.

SEVENTH INNING.

EIGHTH INNING.

For Speed and Accuracy

A SMASHING double to right; a sacrifice; a "squeeze" play—and the home team comes across with the winning run.

Speed and accuracy tell the story on the diamond; and in your morning paper. The crack of the ball on the bat has been echoed by the tap of Corona's keys in the press-box. The report is complete to the last detail.

Such out-of-the-ordinary uses demonstrate Corona's *extra* efficiency. Its lightness and sturdiness, its handy size and unfailing readiness for work, qualify it to do even exceptional things and to do them well.

But Corona finds its real use in the less spectacular field of every-day life. In your home, on trips by sea or land, on your vacation, Corona serves you faithfully and serves you well. Corona is everyone's friend—the typewriter of universal service.

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GROTON, NEW YORK

Branches and Agencies all over the World

$50, with carrying case

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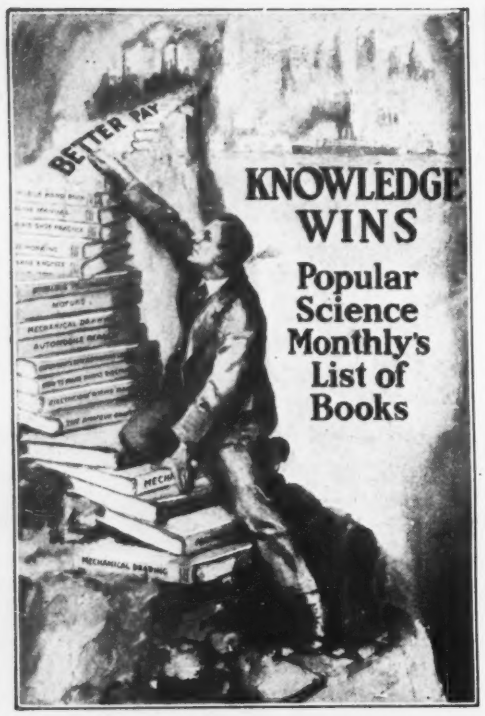
TRADE MARK

Fold it up—Take it with you—Typewrite anywhere



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CONSTRUCTION OF SMALL ALTERNATING CURRENT MOTORS. By A. E. WATSON. This book contains complete instructions for building small alternating current motors in several sizes. The designs will be found in harmony with those of the very best manufacturers and they can be worked out by the amateur for making useful instruments. Fully illustrated.
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STANDARD PRACTICAL PLUMBING. By R. M. STARBUCK. This is a complete treatise and covers the subject of modern plumbing in all its branches. It treats exhaustively on the skilled work of the plumber and the theory underlying plumbing devices and operations, and commends itself at once to everyone working in any branch of the plumbing trade. A large amount of space is devoted to a very complete and practical treatment of the subjects of hot water supply, circulation and range boiler work. Cloth, 406 pages. 347 illustrations.
Price, $3.50, Postpaid.

Book Dept., Popular Science Monthly
225 West 39th St., New York City

An Airplane Shot from a Bow

A GREAT deal of fun can be had with toy airplanes. Here is a novel way of starting them with a common bow. The planes are simple in construction and are started on their flight the same as shooting an arrow.

Shooting the small airplane from a bow does away with rubber bands to drive its propeller. The toy takes on a realistic appearance as it flies away

Below is a brief description of the arrangement of the bow and the airplanes.

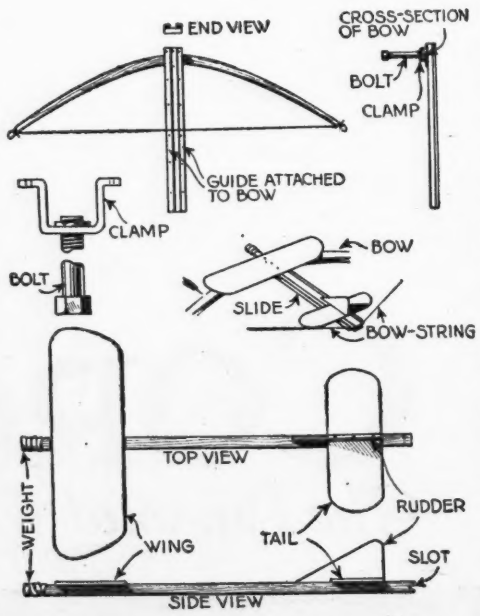
Any bow can be used, provided it is solid enough to propel an arrow a considerable distance.

The guide is made of a strip of wood about 2 in. wide and as long as necessary so the bowstring will not be pulled beyond the end when pulled back the required distance. Nail two light strips of wood, one along each edge, to form a channel in the center of the guide for the stick of the airplane to travel in. Be sure this is well smoothed down with fine sandpaper.

Bend a clamp of stiff metal. Then square the bow at the middle and clamp the guide to the top of it with the clamp. A bolt projects down through the clamp and serves as a handle to hold the bow by, so the hand will not interfere with the movement of the plane. Be sure the clamp binds the bow to the guide tightly enough to prevent twisting.

The airplanes are nothing but wings and stabilizers attached to an arrow. Select a light, square stick about 12 or 15 in. long for the arrow. Near one end tack a wing of stiff, light-weight bristol-board or celluloid. A smaller wing or tail is likewise attached near the opposite end and an upright vane for a rudder. Try each plane first by hand to determine its stability in flight. Changes can be made as necessary by cutting away unbalanced portions of the wings, etc., and adding or reducing weight at the front by using sheet tinfoil or lead as shown. Cut a notch at the tail end for the bowstring.

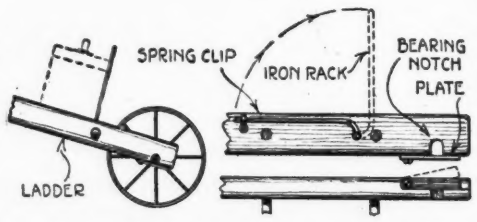
Set the plane in the track of the guide, place the bowstring in the notch, pull back the required distance and let go. The plane will be shot along the guide into the air, where its flight depends upon the force of the released bowstring. Aim it at a slight angle above the horizontal.



The parts are very simple to make and are shown in this detailed drawing

Using the Ladder as a Wheelbarrow

THERE are times when a short ladder has to be loaded on a wheelbarrow with some carpenter's tools and lumber, and pushed to the scene of operations. Why not discard

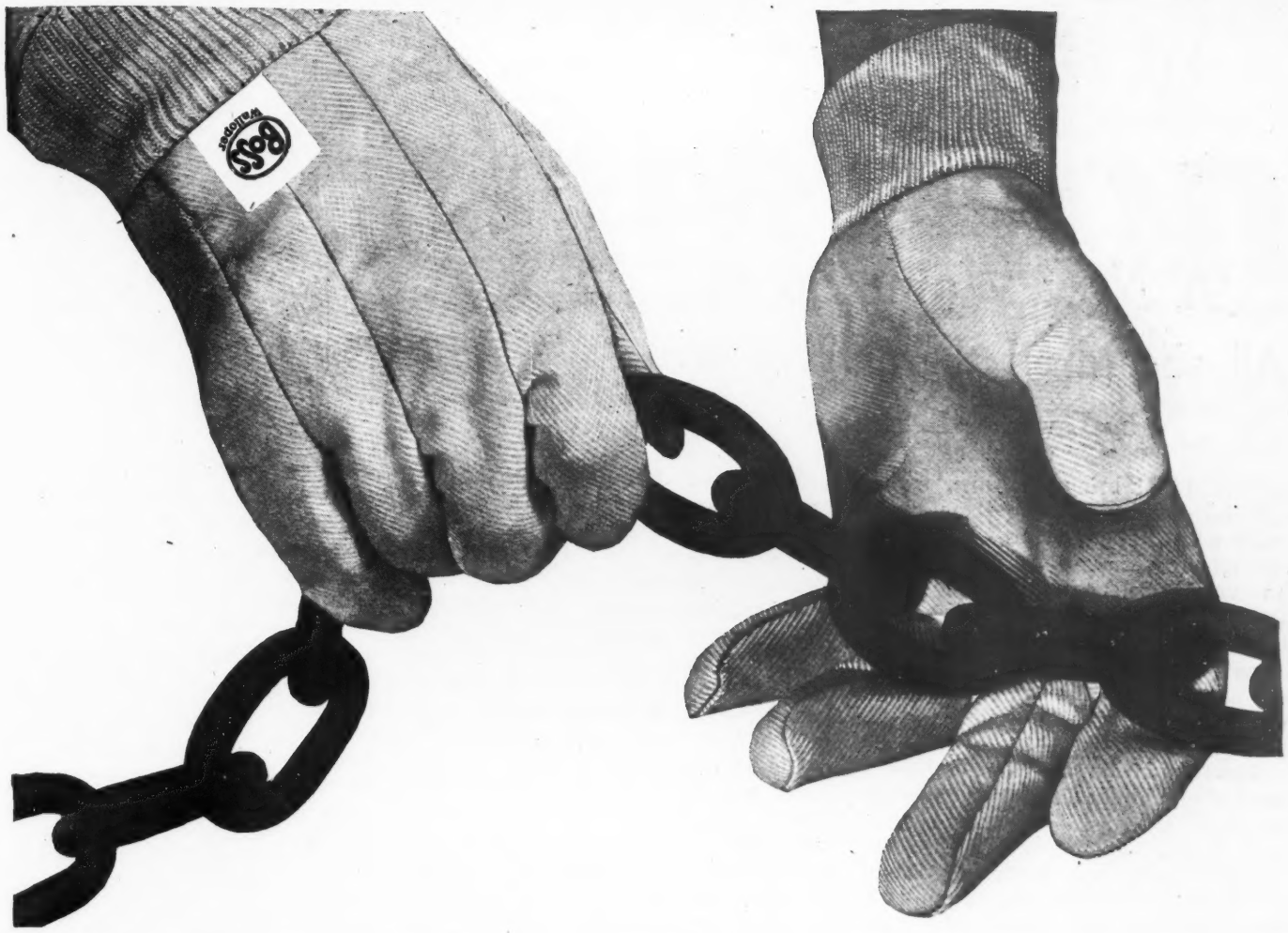


A short ladder may be used instead of a wheelbarrow if the idea in the illustration is adapted to your particular need

the barrow and utilize the ladder for the carrier? This can be done as shown in the accompanying picture.

Cut a round notch, suitable for a bearing to an old wheelbarrow wheel, in each end of the ladder uprights. A metal plate underneath to swing open and shut will hold the axle in place. Then pivot two iron rods, as shown, to the inside faces of the uprights, to be swung vertically when necessary to act as racks for preventing the load on the ladder from interfering with the wheel. These can be folded back and held in place with little spring clips when not in use.

To use, simply set the notches over the wheel axle and close the pivoted plates over the opening. Then raise the racks and let the load bear against them so it will ride as near the wheel as possible. Grasp the opposite ends of the ladder and push it ahead of you as you would a wheelbarrow. Remove the wheel and lower the racks when the ladder is to be used for its regular work.—WINDSOR CROWELL.



The Working Hand's Friend

WORKING hands must be protected or they will suffer from the constant attacks of grease, dirt, paint, dust and minor injuries.

Boss Work Gloves turn the trick. They protect. They wear. They serve. They cost but a trifle. They are the working hand's friend.

And they protect *comfortably*. They wear *well*. They permit you to *"feel" your work*, in spite of their tough texture. They slip on and off easily.

Everybody wants them. Everybody sells them. Everybody needs them. They have a thousand uses.

Your wife needs them about the house. You need them about the shop. Thousands of other hand workers are using them. Buy them regularly. Keep a pair handy—at home as well as at work. Three styles of wrist—band, ribbed, and gauntlet. Sizes for men and women, boys and girls.

This Trade-mark identifies genuine Boss Work Gloves. Be sure it is on every pair you buy.

Boss

Trade *Mark*

THE BOSS **MEEDY**—The world's favorite work glove for odd jobs around the house and garden, and all light hand-work. Made of the best quality, medium weight canton flannel.

THE BOSS **HEVY**—The best bet for all work that requires a strong, wear-resisting glove. Made of the very best quality, heavy weight canton flannel.

THE BOSS **XTRA HEVY**—The world's champion heavyweight handwear for rough work. Made of the finest grade of extra heavy canton flannel.

THE BOSS **WALLOPER**—This is the super work glove. Strong, flexible and built for rugged work. Made of the highest quality, heaviest weight canton flannel.

The Boss line includes highest quality leather-palm, jersey, ticking, and canton flannel gloves and mittens.

THE BOSS MANUFACTURING CO., Kewanee, Ill.

A New Water Sport

All aboard for the airplane dive

By Lawrence B. Robbins

SUMMER brings its own sports and delights, among them swimming and diving. Slides, shoots, and springboards have been adopted to add variety to the fun to be had in the water, but now comes a new one—the slide for life. With a taut wire, some good rollers and an easy incline, one can have all the fun contained in those variations just mentioned.

First to construct is the carrier.

The foundation of this consists of a piece of oak about 2 ft. long, 6 in. wide and 2 in. thick. A little less than 6 in. wide will not matter so long as the strength is there. Along one edge, which we will call the top, fasten with screws a strip the same width and length and about ½ in. thick. This can be removed at any time by removing the screws.

Then cut out two more blocks of 2-in. wood about 1 ft. long and 4 in. wide. Bolt these, one to each side of the long block, about in the middle and so the bottom edge of all three blocks come flush with each other.

Next, get hold of a pair of strong, easy-running barn-door rollers of the single-strap pattern, that is, one of the legs of the two straps ends close to the bottom of the wheel or roller. Screw one roller to each side of the long block in the position shown, so the long strap will butt against an end of the short block on its side. Be sure and place the rollers as close as possible to the removable strip without their touching.

Now bore a 1-in. hole through the three blocks about in the center, taking care to bore it exactly perpendicular to their surface. Have a piece of 1-in. pipe cut 1½ ft. long and threaded at both ends. Force this pipe through the hole by driving with a wooden mallet until equal portions project on each side of the carrier. This is shown in the end view. Then take two 1-in. pipe-caps and drill a hole in the center of each about ½-in. large. Run a strong woven wire rope or solid wire through each hole and hold it inside the cap by tying a large knot in the end. This arrangement suspends the swing or trapeze at the lower end of the ropes. This swing is made of a piece of solid wood with a hole bored in each end to receive the rope, which is knotted underneath. By adjusting the knot on one side or the other the swing can be made to lay horizontally. Suspend it about 2 ft. below the bottom of the carrier.

At one end of the carrier nail on a narrow section of old automobile shoe for a bumper as shown. This is the front end. At the back end put in a screw-eye to which attach a cord used to pull the carrier back to its starting-point when a slide is intended.

The "take-off" consists of a pair of strong posts erected at an advantageous point near deep water. Be sure and place them where there will be no dangerous obstruction to strike the user. Set them vertically about 4 or 5 ft. apart and 10 ft. or so above the surface of the water. Tie them together by bolting a piece of 2 by 6 in. board to them horizontally. Brace them well toward the shore and on the water side if desirable. Turn a large eye-bolt in the middle of this tie-beam, one strong enough to withstand considerable strain.

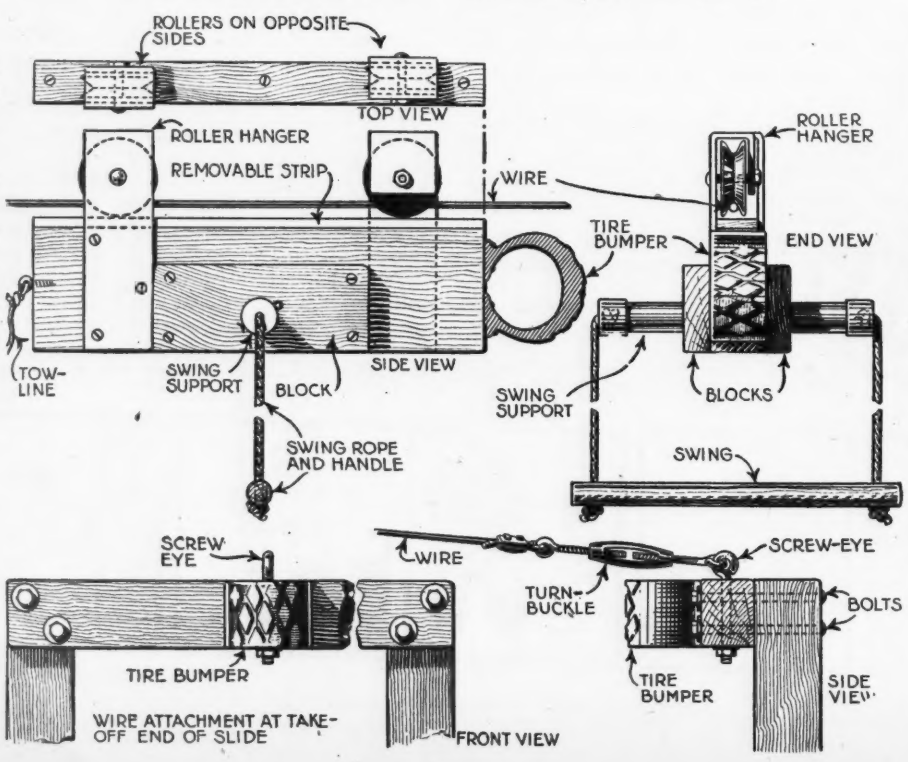
Now proceed to string up the cable which can be made of a flawless length of heavy telegraph wire or of small-diameter wire rope. Let it be a cable strong enough to withstand a heavy strain and if galvanized it will be impervious to the weather. The length depends somewhat upon the pitch to which it is to be suspended, but with a sufficient pitch to attain good speed down the incline, a wire 60 to 75 ft. long should be enough.

Fasten each end securely to a turnbuckle either with wire clamps or by twisting the wire about the eye and securing telephone-wire fashion. Be sure it is strong.

Hook one turnbuckle to the eye on the take-off and set the other over a loop of wire surrounding a tree, pole or similar means of support back from the water's edge and at a greater height than the take-off. The height should be great enough to give a good pitch down toward the take-off and so the carrier will slide

How to Make the Apparatus

The detailed drawing below shows the various parts necessary to make the apparatus. Be sure that all parts are substantially fastened and that the cable is a flawless length of telegraph wire. Determine the speed by using a dummy weight



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Did You Ever Lose a Dollar?

THAT is what it means to you when you drop and break a spark plug. If you ask your garage man, he will tell you that at least one out of every twenty spark plugs is broken in one way or another. Figured on that basis Champion Spark Plugs with an annual output of over 25,000,000 save their users over a million dollars a year on breakage loss alone.

Our famous No. 3450 Insulator has been developed and strengthened to such a degree that car owners who use Champion Spark Plugs are entirely free from spark plug breakage as well as from trouble due to excessive heat, shocks and temperature changes.

There is a Champion Spark Plug specially designed for every type of gasoline engine.

Save money. Order a set from your dealer today. Insist on Champions.

Be sure the name Champion is on the Insulator and the World Trade Mark on the Box

Champion Spark Plug Company, Toledo, Ohio

Champion Spark Plug Company, of Canada, Limited, Windsor, Ontario

What does your key ring tell you?

Take out your key ring—look and see!

Do *all* your keys bear the "Yale" trade-mark? If you don't see "Yale" right on the keys, they are *not* "Yale" no matter what you thought.

"Yale" is our trade-mark. It is on *all* our products, denoting true origin. It guarantees that the product will give the better service which you expect from "Yale."

No one else may use the trade-mark "Yale." It is our signature—our abbreviated corporate name.

When you ask for a Yale lock of any type, door closer or chain block, you can be sure to get "Yale"—by looking for the trade-mark on it before you pay for it.

What does your key ring tell *you?*

Yale products include:

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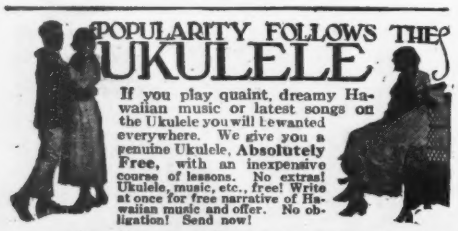
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down at considerable speed, but not enough speed to be dangerous or excessive. This can be determined only by experiment, either by the builder himself or by using a dummy weight. Then draw up on the turn-buckles until the wire is taut and capable of supporting the weight of a person without undue sagging.

Remove the strip on the top of the carrier and slip the wire under the rollers and in contact with them. Then replace the strip. This prevents the rollers jumping off the wire from sudden vibration, etc. By removing the strip the carriers may be taken off at any time for repairs.

Lastly, fasten a second section of automobile tire to the shore side of the take-off just where the bumper on the carrier strikes.

Now you are ready for the slide of your life.

Pull the carrier up to the starting-point by pulling it along with you by the cord. Hang from the swing, lifting the feet from the ground. You will instantly commence a swift descent to the take-off over the water. Then, when you strike the bumper, or slightly before, let go the swing and you will be projected into the water at a speed proportionate to the speed of the carrier.

Experienced swimmers can vary the time at which they release the swing so they will be compelled to turn somersaults in the air, etc., due to the momentum with which they strike the bumper at the take-off. All sorts of stunts can be accomplished and much enjoyment derived from this slide.

How to Make Papier-Maché Novelties

By George F. Kuhne

ALTHOUGH the work herein described is easy to do, it is nevertheless a useful art. A little practice will develop to skill, and all that is necessary to be successful is this practice and a few materials of a simple nature such as plaster-of-paris, wrapping paper, flour, paste, and some clay.

The plaster can be purchased at any paint store, and the clay is found in nearly every hilly section, or it may be bought. Procure some common brown paper such as butchers use for wrapping meats, some old newspapers, and a pot of flour paste. Start with an easy model first, for example, a vase; later more difficult objects can be made, the principle being the same in all of the work.

Add hot water to the clay, knead it with the hands until it is soft enough to be shaped easily, then place it on an old piece of tin or other metal that will not melt readily. Be sure to have enough clay to form a bed for the model.

One can make an infinite variety of things of papier-maché, among them being toy soldiers, dolls, candy boxes, etc.

The next step is to grease the vase with lard or oil and lay it on its side in the clay. Press it down firmly until it is half buried in the clay. After this is done, take a knife and smooth the edges of the clay so that it covers just half of the vase. Now mix the plaster-of-paris with warm water until it becomes workable like putty. Pour it over the vase in such a way that it covers every part not covered by the clay. Make this plaster covering about two inches thick. Next, place the whole thing in an oven, and allow it to remain there until it is dry.

When dry, remove it from the oven and pour cold water on and along the seam that divides the clay from the plaster, using a small tea-pot for the pouring. This will loosen the cast. Allow the water to soak in thoroughly and carefully pry the plaster cast from the vase. It will be a perfect half. In the identical manner make another plaster cast of the other side of the vase; upon its completion you are ready for the papier-mache.

Take several thicknesses of paper and soak them in a basin of water, then wring them out. Spread the paper on the table or flat board and smooth out all of the wrinkles. Apply some flour paste to one side of one sheet of paper. Then grease carefully the inside of the plaster mold and lay the paper in, being sure that the side of paper without the paste is next to the mold. Press the paper down firmly and evenly into the mold.

Place the two molds in the oven. When the paper is dry, remove the molds and carefully extract the paper. Trim the paper edges and paste the two halves together. After the paste dries the vase can be painted as desired.

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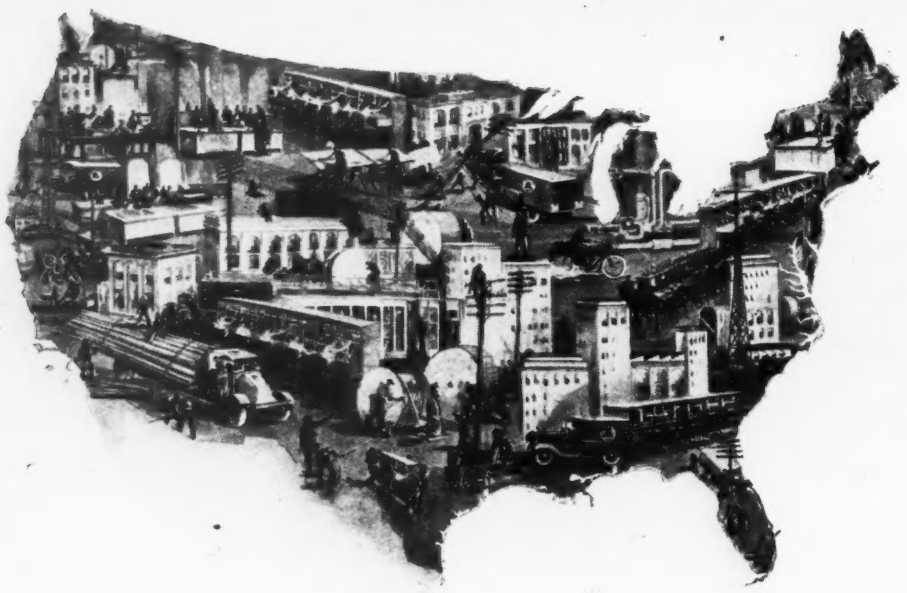

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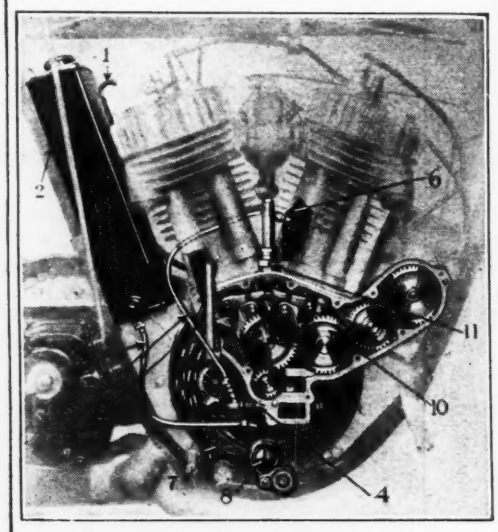
How a Motorcycle Is Lubricated

MOTORCYCLE motors are oiled by a combination of splash and positive feed. The oil is taken from a tank, mounted on the frame of the machine, by means of a mechanically operated plunger pump which is adjustable to meet varying conditions. The oil is fed by the pump into the interior of the crank case in which the fly-wheels revolve. The working parts are lubricated by splash, the fly-wheels throwing the oil on to the bearing surfaces of the motor.

In the illustration, 2 is the oil-tank with the pipe, 3, leading to the intake side of the mechanical oiler, 4.



There is nothing complicated about the lubricating system on a motorcycle. A glance at the illustration shows how the oil is distributed

This oiler is a plunger pump driven by worm gearing from the main shaft of the motor. The oil is pumped through the pipe, 5, to a passage through the rear wall of the front cylinder at 6; it then lubricates the piston and cylinder walls and descends to the crank case, being taken up by the revolving fly-wheels.

The fly-wheels throw the oil as indicated at 7 and send part of it through a port, 9, to the rear cylinder and piston. The oil contained within the crank case is never more than a few ounces in volume, this being churned into a mist immediately the motor is started. A rotary valve is fitted to the gear, 10, which is so arranged that when the pistons descend in the cylinders, communication is established between the crank case and the interior of the timing-gear casing. Some of the oil flows through this rotary valve and into the timing-gear casing, lubricating all gears and bearings within. Surplus oil finds its way out through a breather pipe on this casing and serves to lubricate the front drive-chain.

When extra oil is needed, on long steep hills or at high speed, a hand pump on the side of the oil-tank at 1 is used to send oil through another pipe to the crank case direct.

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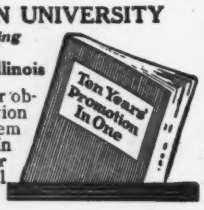

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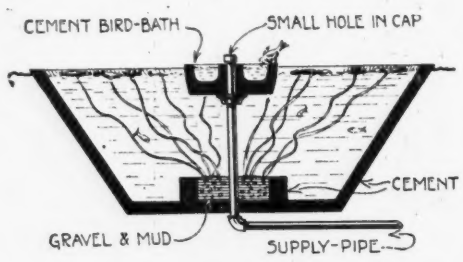
A Lily Pond Built on New Lines

By Windsor Crowell

THE usual method in building a lily pond for decorative purposes in the garden, is to wall up a hole with cement, fill the bottom with loam, set out the lily roots and fill up the remaining space with water.

In the lily pond herein described, however, are several features of design and construction that are somewhat novel. First among them is the separate compartment for planting the roots. It is circular in form and located in the exact center of the pond. Then the supply pipe for water passes up through the center and supports a cement bird bath at the top. As will be seen by studying the illustrations, the lily pads are all growing from the center of the pond and completely surround the bird bath, making a beautiful effect when the flowers are in bloom.



This is the form for the bird bath. The water pipe is set in the center. When filled with sand and tamped down it will make a perfect circle. The ring is made from sheet iron

To secure a circular form for the lily bed is not always easy. It was done in this case as follows: The inside diameter of the bed was first determined upon. Then a strip of sheet iron, similar to roofing iron in weight and flexibility, was procured. In size, it was three and a quarter times as long as the diameter. The strip was riveted together and spread into as circular a form as possible. The puzzle was how to render it perfectly round. It was done in this way: The inside was filled with wet sand tamped down solidly. The result was that the iron was under even pressure from every point and made a nearly perfect circle. This was done of course at the center of the bottom of the pond.

A second strip of metal was riveted together and set around the first, its size adjusted to leave a space of several inches between the two. Sticks of equal length forced between the already round strip and this second one forced the second strip out to a shape similar to that of the inner one. This formed a space for pouring in a cement wall. The sticks were left in the cement. When dry, the two iron forms and the sand were removed. A practically circular wall was left, and was filled with rich loam and some of the natural mud in which pond lilies grow.

As will be seen, the supply pipe passes up through the center of the lily bed. It should not be quite as high as the intended water level.

The bird bath was molded of cement upon an octagonal board of the required size. A short length of pipe the same size as the supply pipe was driven through the center of the board, a flange threading to it and screwing later to the top of the supply pipe.

Then eight pieces of board of sufficient height were nailed around the edges of the octagonal board and the cement was poured in. When the cement was sufficiently hard to allow the sides to be removed, the pipe was let down over a spindle placed vertically in a vise. Then the octagonal block was spun rapidly about the spindle and the soft corners of the block removed by holding an old chisel against them. This was done until it was well rounded. The inside was hollowed out in the same manner. Later, when it was well hardened, it was gone over with one or two coats of thin cement to give it a finish.

When ready it was threaded upon the top of the supply pipe as previously stated. This held it partly out of and partly in the water when the water was up to its maximum level. A cap with a small hole in the center was threaded on the end of this small section of pipe and furnished a nozzle which sprayed the water to a considerable height when it was turned on. One advantage of such an arrangement is that while the center of the pond may always be filled with lilies, the water around the outer edge will invariably be clear.

A New Device for Preventing Tire Punctures

IT is safe to say that during the last twenty-five years, hundreds of patents have been taken out for the prevention of punctures in pneumatic tires. In most of them the central idea was to make the tire impenetrable to nails and pieces of glass, etc. An inventor recently approached the problem from a new angle by studying the process by which the nail gets into the tire. He found that nearly all nails lie flat on the road. In motorcycles and automobiles ninety per cent of nail punctures are in the rear tire. Punctures occur most readily at high speeds and on dry roads. The front tires are pierced by short nails, the rear tires by long nails. From these observed facts he concluded that rear-tire punctures are caused by the front tire turning objects on end, with the result that if the rear tire reaches them before they fall again, it is pierced.

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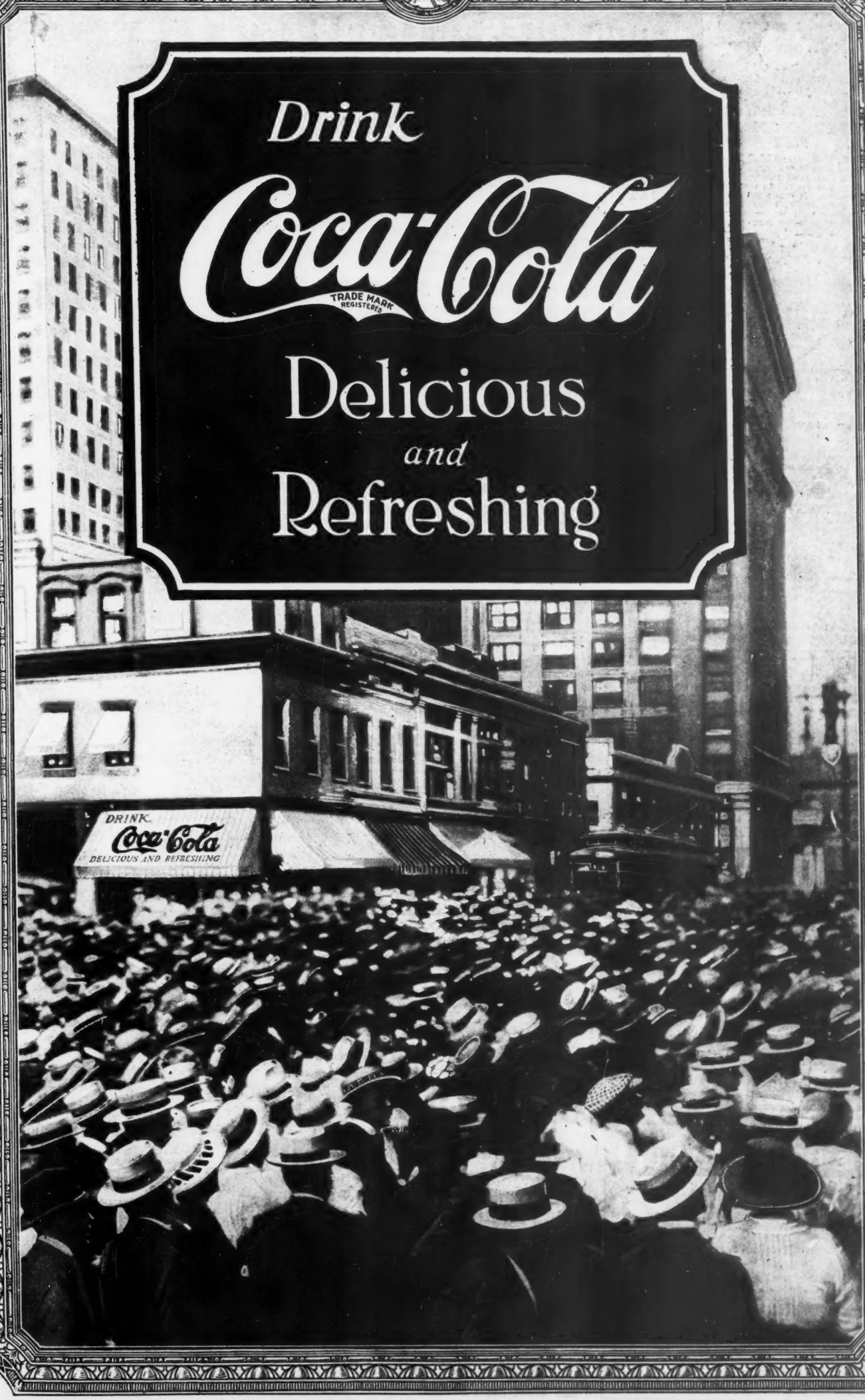

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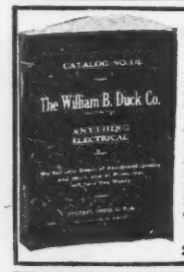

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Popular Science Monthly
225 West 39th Street, New York

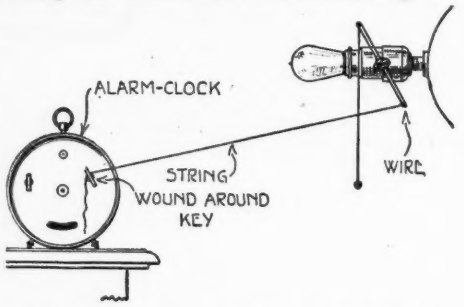
Not only were the nails seen to turn on end, but they were caught "red-handed," as it were, by a high-speed camera. The puncture preventer designed as an outcome of these observations turns down nails as fast as the front tire turns them up, and so the rear tire is saved.

The form that is suitable for motorcycles consists of a rubber canvas flap, 3 in. wide, usually mounted on a scroll spring attached to a curved steel bracket fixed by one bolt through the fore end of the rear mudguard, but occasionally attached to the muffler or to a special adapter. The flap covers the rear tire, and clears the road by half an inch. It lasts for about 25,000 miles, and can be renewed at little cost.

Make the Alarm-Clock Turn on the Light

MANY people need more than an alarm-clock to wake them from sleep. Some need noise, light, and water. For those who wake as soon as a light appears in the room, this method is recommended.

As soon as your alarm-clock goes off, the alarm winder winds a piece of string around itself. This string is



You can't go back to sleep if the light shines in your eyes. The alarm-clock turns it on while it is going off

fastened to a bulb which lights almost immediately, thereby keeping you awake and assuring you of being at the office on time. It is also useful when taking medicine every few hours.

This is easy to make with the illustration to help you. Twist a piece of wire of about 1/16 in. thickness around the socket-switch finger piece, as in the sketch, and attach a short piece of string on the non-operating end and a piece to reach the alarm-clock, the length depending upon the distance the clock is from the light.

The socket will have to be taken apart and the contact points loosened, in order to lessen the resistance, which makes it easier for the clock to wind up the string that throws the switch and makes the light. The operating string is wound as in sketch on to clock alarm key. During the time when the clock is not attached you can use the strings on the light as a chain-pull socket. The arrangement must be tried several times in order to determine the amount of slack string to allow, this depending upon the amount of winding necessary in fixing up alarm.—H. E. MENDE.

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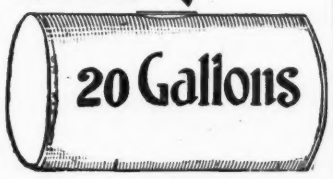

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"We can recommend Miracle Motor Gas to do all you claim for it. We are saving on gasoline bills fully 40 per cent and believe we can do better than that, as the carbon is all gone; that alone is worth more than the cost, to say nothing of the additional power and speed we get."—J. S. Neeland, Los Angeles, Calif.

700 Miles for $1.00

"I am well pleased and satisfied with the results obtained by the use of your MIRACLE MOTOR GAS. Where I used to get 18 miles to a gallon of gasoline, I now get 25 miles, an increase of over 40 per cent in mileage, besides the car runs smoother, picks up quicker, and positively removes all carbon. Seven hundred additional miles at a cost of one dollar is certainly satisfactory."
I. T. A. Lewis, Los Angeles, Calif.

POSITIVE PROOF

G. A. MORGAN, Chemist,
536 Ohio Bldg., Toledo, Ohio,
May 29, 1919.

Charles A. Butler & Co., Toledo, Ohio.

Gentlemen: Enclosed please find analysis of sample of MIRACLE MOTOR GAS.

The material is completely soluble in gasoline at ordinary temperatures. It leaves absolutely no sediment.

It is neutral in reaction, that is, it contains neither acids nor alkalies, and will therefore have no harmful effect on various parts of the engine with which it may come in contact.

It does not contain any oxygen bearing materials, such as camphor, alcohol or ether and its products of combustion will, therefore, be similar in character to those produced by the combustion of high-grade gasoline. G. A. Morgan, Chemist.

A Wonderful Chemical Discovery that Increases the Power of Gasoline Fully One-Third

Big Money Saver for the Motorist, Prevents Carbon, Makes Engine Run Smoother, Saves Gas, and Greatly Increases Mileage.

Don't be skeptical. The impossibilities of yesterday are the realities of today. The entire motor world has been endeavoring to find a remedy for the high cost of gasoline. The remedy has been found. It is here. It is MIRACLE MOTOR GAS. You will be amazed, astonished, at the way this wonderful product multiplies the power of gasoline. An avalanche of letters from all over America proves its worth, testifies that it saves up to 40 per cent gasoline, besides eliminating carbon. Miracle Motor Gas is used WITH gasoline. It is the combination of Miracle Motor Gas and gasoline that gives such phenomenal results. For example, if 100 gallons of gasoline gives you 1,500 miles, 100 gallons of gasoline and one package of Miracle Motor Gas will give you 2,000 miles. We guarantee Miracle Motor Gas to be harmless to the mechanism of your car. We guarantee results claimed for it or money refunded. It is used in every State in the U. S. and in many foreign countries. Start using Miracle Motor Gas today and you will be delighted with results.

A "Show-Me" Offer TO EVERY MOTORIST IN AMERICA

You Mr. Motorist, want to save from *one-third* to *one-half* on your gasoline bills. To prove to you that MIRACLE MOTOR GAS will do this, we make the following liberal offer: Mail the coupon below to us with $1.00. We will send you TWO $1.00 packages ($2 worth) with this understanding: Use them and if you are not satisfied, tell us so, and we will immediately return your dollar. You don't have to return anything. This offer applies on your first order only as we will have an agent in your County within 30 days, and from then on you will have to pay $1 a package.

$200 A WEEK

For You as a "Miracle Man"

Here, now, within your grasp, is the opportunity to make from $5,000.00 to $15,000.00 a year. This new, scientific, chemical discovery opens the road to fortune for one live man in each community. We want Exclusive Representatives everywhere. MIRACLE MOTOR GAS positively gives 15 to 40 per cent more mileage from every gallon of gasoline used in an automobile. It eliminates and prevents carbon, the "black plague" of motordom; makes engine run smoother, and better in every way. At the present high price of gasoline think what it means to save from ONE-THIRD to ONE-HALF on your gasoline bills. MIRACLE MOTOR GAS is the biggest, most sensational success in the automobile field. Motorists are amazed at its wonderful work.

Exclusive Territory, 300 Per Cent Profit,

No Competition, Read on and be Convinced

No matter who you are, where you live, how rich or how poor, this is YOUR CHANCE. You never dreamed of a better Opportunity than this. Realize the tremendous possibilities. Five Million Automobiles in the U. S. need this wonderful product. Thousands of motorists in your County want to economize on gasoline and are eager to buy MIRACLE MOTOR GAS! Don't you see what the EXCLUSIVE COUNTY AGENCY will mean for you? It may mean your fortune. Practically every auto owner buys the minute you tell him what MIRACLE MOTOR GAS is GUARANTEED to do. Delighted customers, astonished with results, will boost it to their friends. Your success is sure, positive. Motorists will literally BEG you for it, once they know what it will do.

GET BUSY — DON'T WAIT

Don't make the mistake of being a doubter and losing this great opportunity. Our guarantee protects you. To convince yourself beyond the possibility of doubt, send us $1.00 and we will send you two packages of MIRACLE MOTOR GAS (Retail price $1.00 each) with the understanding, after you have used them, if you are not entirely satisfied, just write and tell us so, and we will refund your dollar. Remember, MIRACLE MOTOR GAS is a proven, guaranteed proposition. It has demonstrated what it will do and now we want hundreds of live men to sell it. So get busy—send in your order for two packages, or if you prefer, just sign the coupon for complete information about this astounding product. Tell us what territory you want. But you'll have to act quickly as territory is being snapped up very rapidly. Better get the coupon on the way to us with a dollar by return mail. Wire if you want terms for Exclusive Rights for your territory.

THE MIRACLE MFG. CO.
168 Miracle Bldg., Successors to Chas. A. Butler & Co. **TOLEDO, OHIO**
Reference—Commercial Savings Bank & Trust Co.

O. V. Darling, S. Bend, Ind., Makes $210.00 Profit in 4 Hours

"Made a test of MIRACLE MOTOR GAS today on a 103 mile trip. Had two Fords. The one with MIRACLE MOTOR GAS used 3½ gallons of gasoline; the one without MIRACLE MOTOR GAS used 7 gallons."

As a result of this test he sold MIRACLE MOTOR GAS like hot cakes. Writes later: "Sold 600 packages from 10 until 2—four hours ($210.00 profit)."

Dave Isom, Boise, Idaho, Makes $60.00 Profit in One Day

Next comes this letter from Dave Isom: "My whole heart and soul are in this work. The Commercial Club of 4,000 members is boosting for me. Everyone is wel pleased. Have two more men working for me. Send me 800 more packages by express. Can't afford to be waiting for goods. Sold 90 packages yesterday." (That's over $60 profit.)

Vollbrecht Will Order in Carload Lots

And then read this letter just received from R. Vollbrecht: "Miracle Motor Gas a big success. My 6 dozens were gone in two hours. Ship 50 dozen by return express. Will have to order in car load lots soon. Miracle Motor Gas is a wonderful proposition."

What Are You Going to Do?

Are you going to "get in" on this opportunity—are you going to be one of the big money makers? Why work for a bare living when you can make hundreds every week? Don't let this chance slip by. Sit right down now and write us. Show the kind of stuff you are made of—show folks that you, too, can make big money. Anyone with ambition and a willingness to work can make good with Miracle Motor Gas. Read all those letters again. They prove you take no chances. Or, wire our bank. They'll tell you how we stand.

MAIL THIS COUPON TODAY!

THE MIRACLE MFG. CO.,
168 Miracle Bldg., Toledo, Ohio

If your proposition is all you claim for it, would like the exclusive agency for

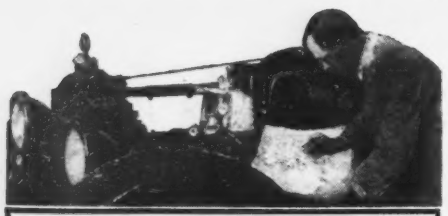
.....County.

Enclosed is $1.00 for two packages of MIRACLE MOTOR GAS. (Retail price $1.00 each). If I am not satisfied after I have used them, it is understood that you will refund my dollar.

Name.....

City.....

State.....



$50 to $100 a Week as an Automotive Electrical Expert

You can quickly qualify for a highly paid position in the great new field of Automotive Electricity. Big salary jobs are open in all parts of the country to experts in starting, lighting and ignition as applied to automobiles, motor trucks, tractors, motorcycles, aircraft, farm lighting plants, etc. Our Free Employment Bureau helps you to a good position in this clean, interesting work.

Earn While You Learn

Twelve weeks of intensive, full-time training makes you a master of all kinds of Automotive Electrical equipment. If you prefer to earn your way while learning, you may devote part time to a well-paid position in Milwaukee which we will secure for you. Low tuition fee; dormitory and other special privileges.

Big Free Book Write to-day for our new, fully illustrated book on Automotive Electricity which we will be glad to send you without obligation. Find out about the opportunities in this great new field and learn about our efficient method of training. Do not miss this chance to slip into a $50 to $100-a-week position. Send a postal to-day.

SCHOOL OF ENGINEERING OF MILWAUKEE
Dept. 8-H—373 Broadway, Milwaukee, Wisconsin

FREE Puncture Proof TUBE
6000 Mile Guarantee

UNION TIRES represent the highest standard in reconstructed tires. Their reinforcement of 4 extra layers of fabric reduces greatly blowout and puncture possibilities. Over 200,000 in use. To further increase mileage, we include with every tire ordered A PUNCTURE PROOF TUBE FREE that under ordinary conditions will last ten to 20,000 miles. Our 5,000-mile tire guarantee certificate with every tire.

Prices Include Tire and Tube

30x3	$7.40	32x4½	$12.00
30x3½	8.50	33x4½	12.50
32x3½ S.S. only	9.10	34x4½	13.15
31x4	10.35	35x4½	13.40
32x4	10.70	36x4½	13.85
33x4	11.15	36x5	14.85
34x4	11.50	37x5	14.95

Reliner Free With Every Tire

State whether you want straight side or clincher, plain or non-skid. Send $2 deposit for each tire ordered, balance C.O.D., subject to examination, or 5 percent discount if full amount is sent with order.

UNION RUBBER COMPANY
Dept. 90 Racine Ave. & 15th St., Chicago

Be a Mining Engineer

A great profession not overcrowded. The Michigan College of Mines (est. 1886) located in the heart of one of the greatest copper mining districts of the world offers a unique combination of theoretical instruction with practical experience in a four year course which can be completed in three calendar years. Its breadth affords foundation for expert specialization in that field of engineering which most appeals to the student. Great mines, mills, smelters, electrolytic and power plants are practically a part of the college equipment and constitute a factor of enormous value in the course of instruction. **Managers of large operations regularly lecture to classes.** Region affords unusual opportunities for geological study. Nine buildings. Advanced Methods. Vigorous Athletics, Bowling, Billiards, Tobogganing. "M.C.M.Men Make Good."

For descriptive book address 262 College Ave., Houghton, Mich.

Michigan College of Mines

GET BIG BUSH OFFER

We do not deal through distributors but County Agents only.

Big Money-Making Offer for County Agents Only

GET OUR BIG MONEY CATALOG TODAY. Don't wait! Learn how you, in your spare time can make Big Money, introducing Bush Cars in your County. The cars with Money-Back guarantee. Bush light four and De Luxe six. Don't wait. Write today!

BUSH MOTOR CO., Chicago, Illinois, Dept. H111 Bush Temple

BE AN EXPERT

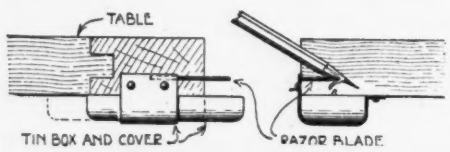
Penman

Wonderful, new device, guides your hand; corrects your writing in few days. Big improvement in three hours. No failures. **Complete outline FREE.** Write C. J. Ozment, Dept. 52, St. Louis, Mo.

Can You Sharpen a Pencil with One Hand?

By Leon Aker

"NOW where did I put that knife or razor-blade?" Then you waste about half an hour of your valuable time looking for it. When you finally find it, you proceed to make your room untidy with the lead and shavings on the floor, besides shaving the skin of your fingers with the safety-razor blade and wasting a good part of your fifteen-cent pencil.



By drawing the pencil over the slant of the razor blade it is easily sharpened

With the simple arrangement illustrated in the sketch shown above you can hold your T-square with one hand and sharpen your pencil with the other, long, short, flat or round, just as you wish, and no shavings on the floor.

An old safety-razor blade (one of the rigid kind) and an old tin box with a cover is all that you require. The latter should be about 2 in. wide, 3½ in. long, and about ½ in. high; one of those "assorted nail" boxes you can buy at the ten-cent store will do nicely.

Remove the lid and with a pair of scissors cut off the two long sides, and straighten out the ends. Then place the box in the middle and bend up the ends of the now flat piece of tin on each side, leaving one side straight up and the other bent out, making a double bend, parallel to and slightly above the top of the box. Now nail the straight end to the front edge on the right side (if you are right-handed) and the *Z* end to the under side of the board, being sure that the box slides fairly easily in the channel you have made.

Finally, hammer the razor blade into the front edge, leaving about half of same outside and over the tin box.

To use this homemade pencil-sharpener, simply hold your pencil firmly in one hand and draw it at a slant over the edge of the blade, when the shavings will fall in the box, which can be pulled out and emptied when full.

Compelling Attention with a Moving Sign

AN enterprising business man who realized the possibilities of moving advertisements before the public, installed a novel device in his place of business which slowly carried a series of small advertisements before the eyes of the public.

The arrangement consists of an electric-motor-propelled belt which was made up of the cloth-backed advertisements, themselves, rolling on two vertical rollers.

A step-down gear was procured with a ratio of about thirty to one, which was connected to the motor. The whole was housed in a long box as shown in Fig. 1 and each end was enclosed to hide the mechanism and the rollers. Between them glass protected the belt from dust.

The motor was housed in one of the end boxes, and the step-down gear arranged as shown in Fig. 2. The rollers were made of 24-in. hardwood,

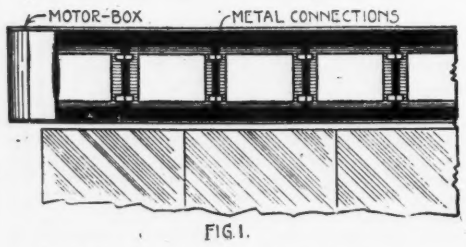


FIG. 1.

This shows the whole mechanism housed in a long box. Glass protects the belt from dust and foreign matter

and were provided with a wide metal disk on the lower ends to prevent the cloth belt from working off, and stopping the mechanism.

In use, the belt was made up of rectangles of cloth with the hinged clips used for fastening small belts together each the same size. Space was then sold to business firms about the town at so much per square, and after the advertisement was made up it was pasted on the front of the cloth strip.

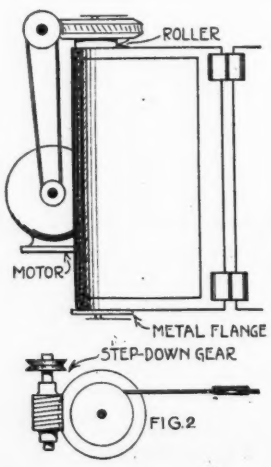
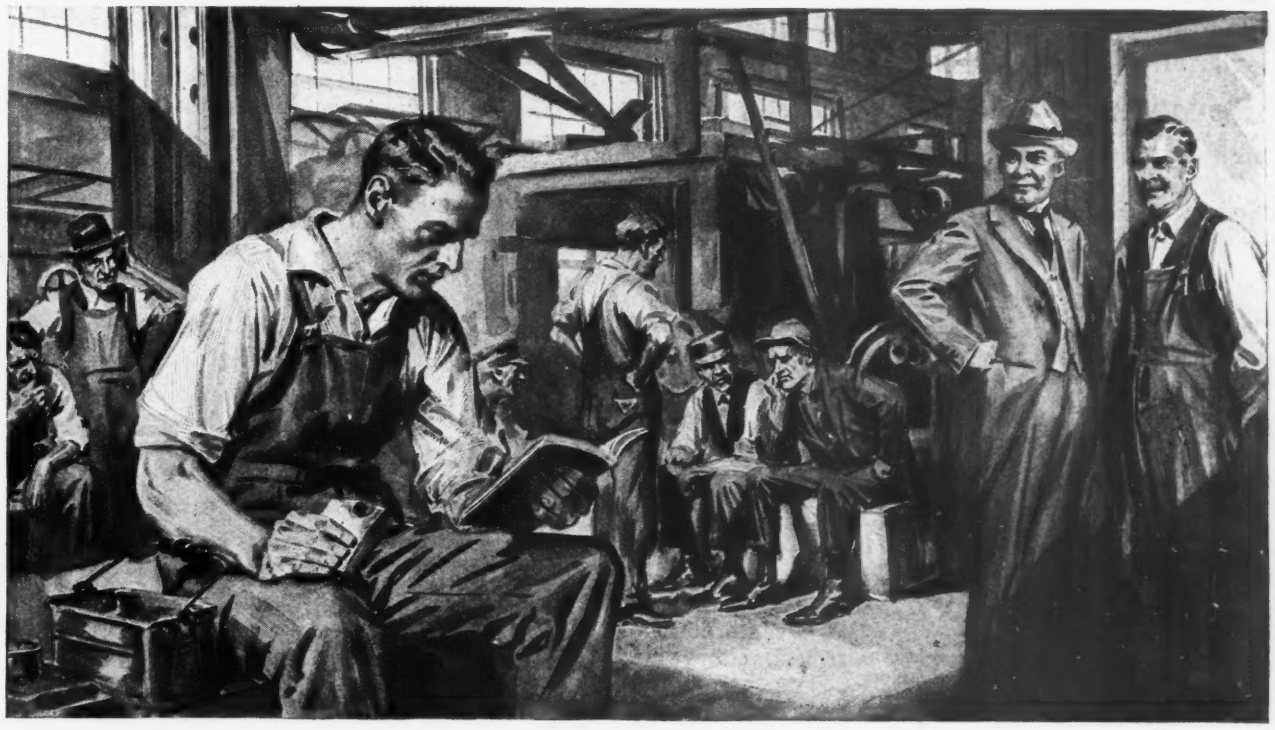


FIG. 2

How the step-down gear was arranged. The rollers were made of 24-inch hardwood

The idea was so successful that several similar devices were installed in other public places, each paying a royalty to the inventor.

The advertisements used were of the same size as the advertisements commonly carried in street-cars, while their length was determined by the amount of vacant space over mirrors, etc., which was to be utilized.



"Keep Your Eye on Jim!"

"It's not alone what a man does *during* working hours, but *outside* of working hours—that determines his future. There are plenty of men who do a good job while they're at it, but who work with one eye on the clock and one ear cocked for the whistle. They long for that loaf at noon and for that evening hour in the bowling alley. They are good workers and they'll always be just that—ten years from now they are likely to be right where they are today.

"But when you see a man putting in his noon hour learning more about his work, you see a man who won't stay down. His job today is just a stepping-stone to something better. He'll never be satisfied until he hits the top. And he'll get there, because he's the kind of man we want in this firm's responsible positions. You can always depend on a man like Jim.

"Every important man in this plant won out in the same way. Our treasurer used to be a bookkeeper. The sales manager started in a branch office up state. The factory superintendent was at a lathe a few years ago. The chief designer rose from the bottom in the drafting room. The traffic manager was a clerk.

"All these men won their advancements through spare time study with the International Correspondence Schools. Today they are earning four or five times—yes, some of them *ten* times as much money as when they came with us.

"That's why I say that Jim there is one of our future executives. Keep your eye on him. Give him every chance—he'll make good!"

Employers everywhere are looking for men who really want to get ahead. If *you* want to make more money, show your employer that you're trying to be *worth* more money. If you want more responsibility, show him you're willing to *prepare* yourself for it.

For 29 years the International Correspondence Schools have been training men and women right in their own homes after supper, or whenever they had a little time to spare. More than two million have stepped up in just this way. More than 110,000 are studying now. Ten thousand are starting every month. Can you afford to let another priceless hour pass without making *your* start toward something better? Here is all we ask—without cost, without obligation, mark and mail this coupon. It's a little thing that takes but a moment, but it's the most important thing you can do today. Do it now!

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 7686, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Railways
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN OR ENGINEER
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ Ship Draftsman
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Textile Overseer or Supt.
- ☐ CHEMIST
- ☐ Mathematics
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Window Trimmer
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ Railroad Trainman
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BUSINESS MANAGEMENT
- ☐ Private Secretary
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Public Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERATING
- ☐ Auto Repairing
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

Canadians may send this coupon to International Correspondence Schools, Montreal, Canada

7-25-19

August, 1920

Just Published

Experiments with 110-Volt Alternating Currents

By J. D. ADAMS

Why does the young electrician seldom have any practical knowledge of the 110-volt alternating current—the most important form in which electricity is used commercially?

This condition exists because the many books for the beginner, excellent though they are, all seem to so carefully avoid the alternating current as though it were something that the youthful electrician should not tamper with.

The purpose of this book is to show the amateur electrician that the 110-volt commercial circuit may be handled with perfect safety and without involving the expense necessary to maintain a power supply.

The only way to gain a thorough understanding of electricity, as it is used commercially, is by direct personal experiment. The knowledge thus gained is of vastly more value and importance than that acquired from the performance of the stereotyped series of battery experiments so uniformly described in the text-books.

The many experiments described in this book were all performed at a time when neither a machine shop nor a laboratory was available. The apparatus involved was necessarily made as simple as possible consistent with the securing of striking results.

Fully Illustrated

Price, Postpaid, - - $1.75

The Greatest Book

Ever Offered to the Public

1920 EDITION——JUST READY

TWENTIETH CENTURY BOOK OF

RECIPES, FORMULAS and PROCESSES

10,000

Trade Secrets
Practical Receipts
Chemical Processes
Scientific Formulas

HOW TO MAKE EVERYTHING

FOR THE HOME,

THE FACTORY AND THE WORKSHOP

Antiseptics, Waterproofing, Lubricants, Rust Preventatives, Dyes, Filters, Cleaning Preparations, Enameling, Beverages, Inks, Adhesives, Polishes, Disinfectants, Flavorings, Cosmetics, Ceramics, etc., etc.; how to make fly paper; to color flowers artificially; to estimate weight of ice by measurement; to make materials fireproof; to work with metals—aluminum, brass, etc.; to make anything and everything, from A to Z.

THIS IS THE BOOK

every one who seeks PRACTICAL, ACCURATE KNOWLEDGE and guidance in his everyday work MUST HAVE at his command.

It is a money-maker and a money-saver; it appeals to the young as well as to the old. Great business enterprises owe their success to the manufacture or sale of simple inventions or compounds, usually the result of an experiment at home. One parent writes: "I am supporting myself and two small children from the sale of toilet articles I put up by following directions in your book."

Profit by the knowledge that has made others successful. GET THIS BOOK TODAY.

Price, Postpaid, $4.00

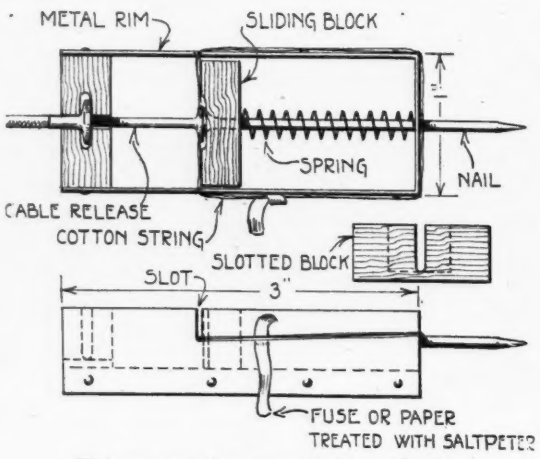
Popular Science Monthly
225 West 39th St., New York

To Take Your Own Photograph

WHEN you want to take your own picture, or automatically operate the shutter of your kodak for any other reason, the following self-operating release can be used to good advantage. It is simple in construction and will do good work.

Make the base of a piece of hard wood 3 in. long, 1 in. wide and ½ in. thick. At one end glue and nail a small block of wood the width of the base, and about ¾ in. thick. Through the center of the block cut two slots at right angles to each other and nearly the full depth. These should be rounded at the ends slightly. Cut them about 3/16 in. wide. Next, tack a rim of light sheet metal about the remaining three sides of the base. This should come flush with the top of the cross-slotted block just mentioned. Drill a hole in the center of the end opposite the block, large enough for a wire nail to pass through easily.

A second block of wood, called a sliding block, is next in order and must be slightly narrower than the distance between the sides of the rim so it will slide back and forth. Make a depression in the forward side and carefully drive a long wire nail through the block, sinking the head in this depression. The shank should go through the hole in the metal end and act as a guide for the block when moving back and forth.



This automatic camera release shutter enables you to take your own picture. A slow-burning fuse does the trick

Place a spiral spring over the nail between the block and the back rim. The spring should exert a tension when the sliding block is first pressed forward against the cross-slotted block.

Measure the distance from the flange on the end of the cable on the camera to the push button on the rod, and press back the sliding block a trifle more than that distance. Then file two slots in the metal rim as shown. Tie the block in this position with a cotton string which passes about the outside of the rim and through the slots just mentioned.

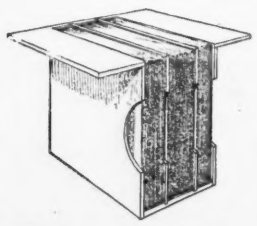
To operate, proceed as follows: Set the cable and flange in the slotted block as shown in the perspective sketch. Then set the push button in the depression in the sliding block and tie that back far enough so that no pressure is brought to bear against it. Tie it in this position as previously described. Slip a piece of fuse or strip of paper, soaked in a solution of saltpeter and dried, between the rim and the string. When lighted either one will smolder slowly until it reaches the string. Then it will burn through and release the spring which will push the block forward and operate the cable release to the camera shutter.

The time of operation will depend upon the length of the burning fuse.

A Solution of the Telephone-Book Problem

THE most unsightly thing about the average telephone is the dilapidated, though necessary, directories which must be kept always handy.

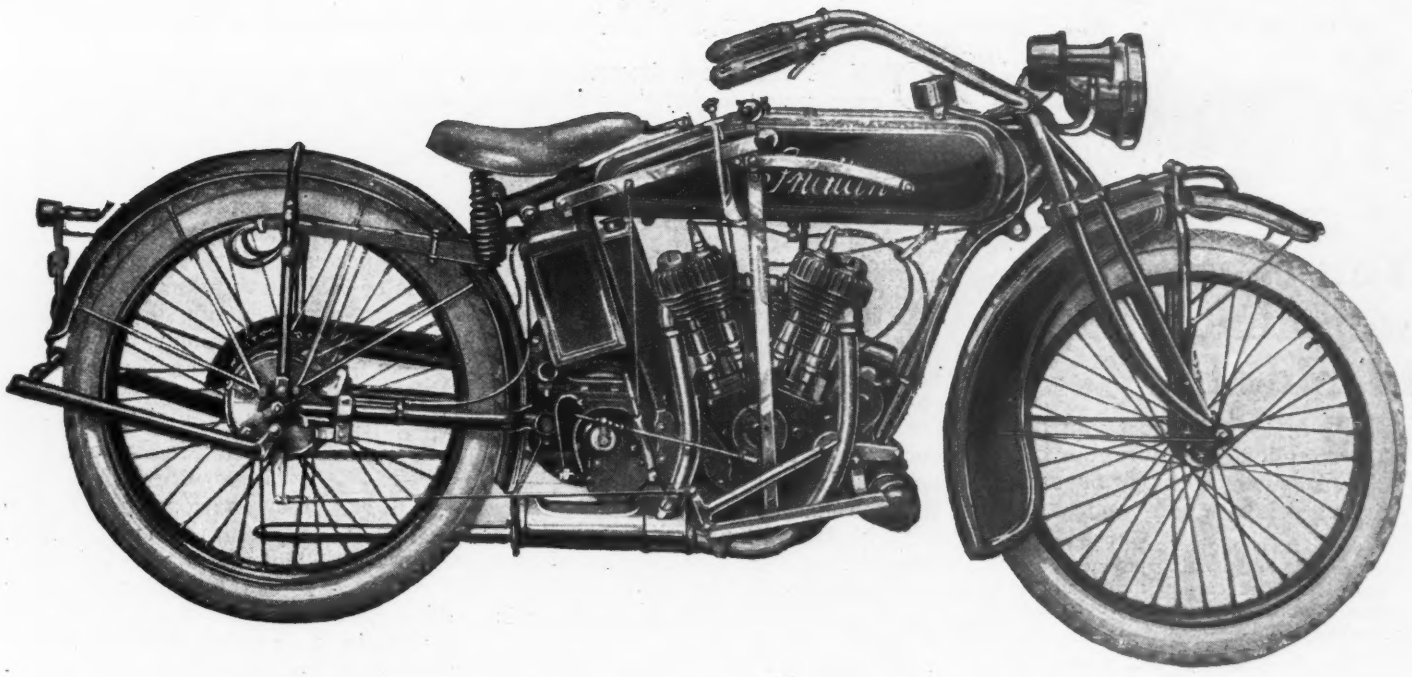
The illustration shows a novel and at the same time practical device for keeping the books handy for reference, while at the same time it neatly disposes of them and also provides a good desk upon which they may be opened for reference.



When you are in a hurry to telephone, the directory is usually not to be found. This little book-holder and -rest keeps it always at hand

The handy man will be able to construct this little cabinet without difficulty as it is very simple in design. It can be made with two or three compartments to suit the number of books it is necessary to hold, but the suggestion is made that if only two compartments are used the top extensions be made sufficiently long to completely support the book when opened. The compartments should be wide enough to allow the book to slip in freely; for the book gets gradually looser with continued handling. The cabinet should be made in a size to hold the books just level with the top and front. This will make the outfit neat in appearance.

The holder illustrated was constructed of ½-in. stock for the back piece, the bottom piece, and the side shelves. The remainder was made from ¼-in. stock. Two 2-in. strap-iron right-angle corner braces were placed underneath the side extensions to keep them rigid, and the cabinet, after having been neatly stained to match the telephone box, was secured to the wall directly underneath the telephone, where it was held by two good-sized screws through the opposite sides of the back board.



Merited Supremacy

Monarch of the Motorcycle World is the Indian Powerplus Big Twin.

It represents years of arduous endeavor in mechanical refinement by the largest manufacturer of motorcycles anywhere.

It was born to regal strength and domination. Mile after mile of highway — good and bad, muddy and rough, dusty and snow-drifted—has passed beneath its sturdy tread. And with the miles and the years and the victories, it has gained in power, prestige and popularity.

Today the Powerplus commands the ingenuity of the best engineers, the skill of the best mechanics and the pride and patronage of the largest fraternity of enthusiastic friends, dealers and riders in the wide world.

It has served in the commerce and pastimes of peace. It has fought in the fiercest of wars. And the record of its performance proclaims it a leader in stamina, power and dependability.

Ally yourself with Big things—the Big out-of-doors, the Big men who are enjoying clean, man-size motorsport. Give your red blood a chance. Look up your nearest Indian dealer today—and *get acquainted.*

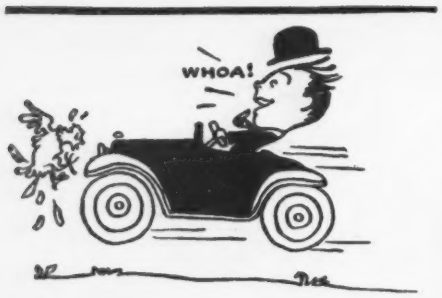
Department 38

HENDEE MANUFACTURING COMPANY, Springfield, Mass.

The Largest Motorcycle Manufacturer in the World

Indian Motocycle

For Sale by Dealers Everywhere



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Garco is as tough, strong and enduring as able brake lining engineers can make it. First grade material and careful workmanship are woven into every foot.

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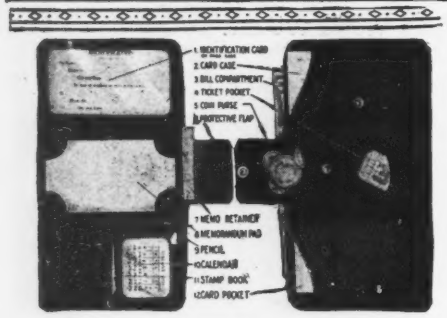

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The "American Gentleman" bill-fold is made of genuine leather through and through. A good-looking bill-fold that you will be proud to carry on any occasion. It is neat, compact, and combines 12 features that you need daily. (See picture). Stitched throughout, no edges pasted. After owning one you wouldn't be without it. In tan or black, $1.50 at any dealer's. Or send $1.50 and your dealer's name and we will mail you one postpaid.

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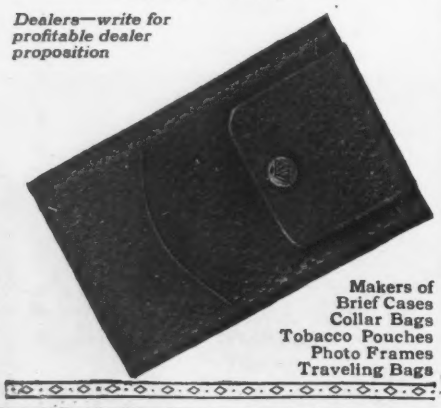

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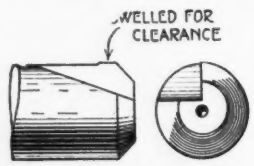
Popular Science Monthly, 225 West 39th St., New York

Simple Reamers Made with a File

By Judson de Graff

ONE of the most frequently encountered "stickers" in automobile-repair work is the odd-sized bushing which comes undersized and which shrinks still smaller during the operation of pressing it into the hole it is to occupy.

The usual procedure in the absence of a complete set of standard reamers is to lap away the surplus material with a strip of emery-cloth wrapped on a short length of rod or to scrape away with a three-cornered scraper until the hole is large enough so that the shaft or pin which is to be entered will slip through. Either method is unworkmanlike and unless it is carefully and slowly done it produces an uneven fit.



You can do an excellent job with this kind of reamer

The remedy is a simple one. It consists of constructing a reamer like that shown in the illustration, which may be made with a file.

A piece of cold-rolled steel which is the same diameter as the finished size of the hole in the bushing, is deeply notched with a file, that side of the notch which is to be the cutting face being cut parallel to a plane drawn through the center, and parallel to the length of the piece. The corner should be chamfered the circumference of the shaft on the end, cutting deeper as the cut proceeds away from the cutting edge. This is to give the cutting point clearance the same as a drill or any other reamer.

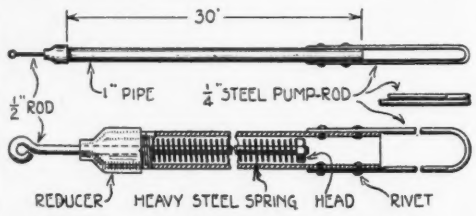
On account of the fact that this style of tool cuts up along the side of the cutting lip as well as on the point, it is necessary to give this lip a slight clearance also. If this is not done, the tool will wedge in the hole. This is done with a few light blows with a punch on the edge of the cutting face. The metal which is thus forced out is then carefully dressed off and the tool case hardened by heating to a bright red and rolling in potassium-cyanide several times, followed by plunging it into cold water.

If the pin which worked in the original bushing is not to be used again and it is found to have an end which is not in the least worn, it makes ideal stock from which to make the reamer, for it is already the size needed. On account of the single cutting edge. the rest of the tool acts as a guide.

A Towing-Rod Made from Gas-Pipe

By Dale Van Horn

A TOWING-ROD for use by the individual car owner or the garage man, may be made easily from a length of 1-in. gas-pipe, a steel rod and a 2-ft. coil spring.



Discard the old rope that breaks continually and make this towing rod for your car. It does the work without straining the car's mechanism

Secure a length of 1-in. gas-pipe 3 ft. in length, thread one end and screw on a reduction nipple with a hole slightly larger than the diameter of a ½-in. rod. Get a 2-ft. length of steel coil spring that will fit loosely into the pipe, preferably of 3 16-in. steel stock.

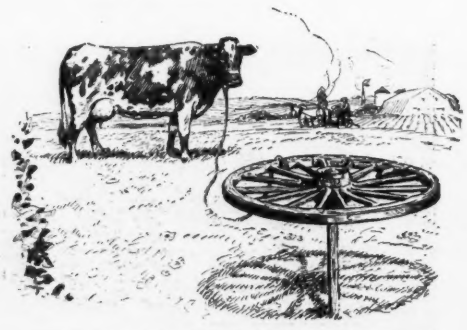
Then heat a ½-in. rod and shape a thick head large enough to prevent the spring from slipping off, yet small enough to slide loosely within the gas-pipe. Place the spring on the rod, run it into the pipe and extend the end of the rod through the hole in the reduction nipple, and shape it into an eye as shown in the illustration.

Bore two holes in the rear end of the pipe ¼ in. in diameter and flatten the ends of two steel pump rods, drill and bolt to the pipe as shown. Then bend the free ends of the rods into hooks, so that, when released, they will fit one over the other.

When used, the hooked ends of the pump rods are slipped over the front axle of the car to be towed.

Give that Cow More Rope

THE illustration shows a very good method of tying cattle or horses so that they may have free range without entangling their ropes.



Bossy can't entangle her hitching-rope if it is attached to a wheel which revolves as she moves about to graze

Secure an old cart-wheel and its axle. Set the off end of the axle in the ground with the wheel uppermost, then tie the cow's rope to this wheel.

Cross Out These Mistakes in Shaving

End hot towels, finger rubbing and the other daily faults

Science has been turned to shaving. And a new method of softening the beard has been perfected.

This method is embodied in Palmolive Shaving Cream. It eliminates hot towels and finger rubbing. It makes shaving easier than you have ever known it. And quicker. And more delightful.

We wish men to know this from their own experience. Hence we offer free, a trial tube of Palmolive Cream to every man who requests it.

The oil coat on the beard

Every hair of the beard has an oil coat. The ordinary lather fails to act effectively on this oil. Thus it is hard for the water to penetrate the beard and soften it. Hence men use hot applications and rub with the fingers.

It is different with Palmolive. The lather instantly emulsifies the oil. Then the beard—a horny substance—quickly absorbs water. It absorbs 15 per cent of water within one minute after lathering, as proved by laboratory tests. And that makes a wiry beard wax-like.

Stays foamy 10 minutes

Palmolive makes a richer, creamier lather than you have ever known. And it stays moist and foamy on the face 10 minutes. You don't have to relather.

A mere bit is ample for a shave. For Palmolive multiplies itself in lather 250 times. There's enough for 152 shaves in the regular size. A cream so active, you know, is something new.

Palmolive is also a lotion. It contains palm and olive oils. Thus it soothes and refreshes the skin, and gives a delightful "after feel."

Try it free

Put Palmolive to the test. Satisfy yourself as to its amazing qualities. This you can do at our expense. We will send you a trial tube absolutely free.

Take advantage of this offer today. Clip the coupon now, before you forget. You will know shaving as a new thing after you have tried Palmolive.

Hot towels—not needed

Finger rubbing—a second mistake

Too light a lather—a third mistake

Lather that dries—a fourth mistake

Large size tube at druggists, 35c

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A Comfortable After-Dinner Lean-Back Chair

MANY of us like to lean back on our kitchen chairs, to rest more comfortably after sitting straight for any length of time, especially after a meal, to smoke or read. The illustration shows how easily one can attach a rocker arrangement on the

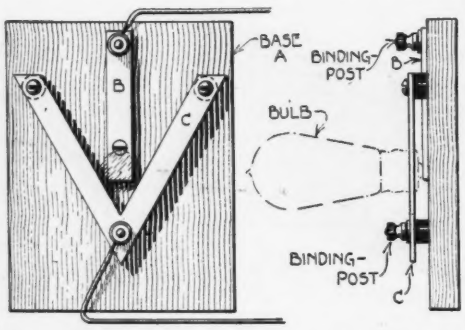
Short rockers attached to that comfortable straight chair will transform it into a rocker

back legs of a chair, and the advantages are: It eliminates all dents, holes and all wear and tear on your floor-covering; acts as a silencer when moving chair around the room, and provides you with a rocker.

The rockers can be made of wood, iron, or steel, which will give you the thickness that is to be taken off the back legs, which also must be rounded to fit the curve of rocker. The best length for the rocker was found to be 5 in. and the curve is made to suit the person using the chair most. When fastening, make sure to use long strong screws strong enough to stand the leaning strain.—H. E. MENDE.

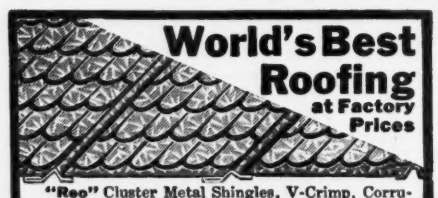
A New Device for Testing Electric-Light Bulbs

THERE are many ways of testing electric bulbs, but the method described herein is one adopted by a



For those who have numbers of electric-light bulbs to test this device will speed up the work

large motion-picture house using literally thousands of bulbs in its illumination and where testing is almost a daily occurrence.



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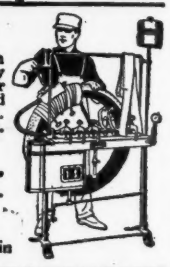

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A baseboard, A, was made of a piece of non-conductive material 10 in. long by 8 in. wide. For this purpose, hard rubber, marble, slate or some such material can be used.

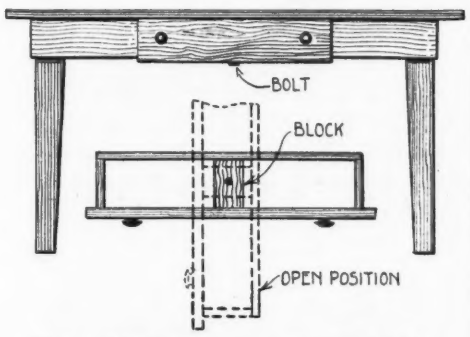
Down the center a line was scratched as a guide for assembling the two contacts *B* and *C*.

Contact *B* was a strip of heavy brass reaching about half-way down the base. This was connected to one of the main wires of the electric circuit. A binding-post here would make the tester portable. Contact *C* was a piece of brass cut in the shape of a large V. This straddled contact *B*, the bottom of the opening coming just below the bottom of *B*. It should also be raised from the base ½ in. so the sides of the bulb screw will touch it. This can be done by setting three little blocks of material under the ends and the point of the V. Connect the point with the opposite main wire of the circuit.

Bulbs are tested by setting the end against *B* and sliding down until the sides of the screw come in contact with the legs of *C*. Testing can be speeded up with this apparatus.

A Satisfactory Table Drawer that Swings

THE chief objection to drawers, racks and the like that turn on a hinge or pivot, is that they often sag or stick on account of the weight they support. There is shown here a method of construction that overcomes this difficulty. The drawer is made with two compartments, the partition between them consisting of one or more blocks equaling the depth of the drawer. A hole is bored through the blocks and also through the top of the table or bench, and through this hole a bolt is passed from above. With washer and nut on the lower end of the bolt, the drawer is supported in position so that it may be swung in either direction, depending on which compartment it is desired to reach. The head of the bolt should be countersunk in the table-top, while a thin washer on top of the central block will cause it to turn freely without binding. This is superior to a sliding drawer in many ways, especially for kitchen table and work bench. Every part of it is more quickly reached, and there is never the danger of pulling it out and spilling all the contents.—H. F. GRINSTEAD.



Your table drawer cannot sag or stick if it is improved as shown in the illustration

After 10 Days

Your teeth may also glisten

All statements approved by high dental authorities

Millions of teeth now glisten as they have not done before. You see them everywhere.

A new method of teeth cleaning has, in late years, come into very wide use. Thousands of dentists are urging it. Multitudes of people have proved it and adopted it. And every person is now offered a free ten-day test.

To combat the film

The purpose is to combat the film which causes most tooth troubles. Film is that viscous coat you feel. It clings to teeth, enters crevices and stays. In the months between your dental cleanings it may do a ceaseless damage.

It is the film-coat that discolors, not the teeth. Film is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea

Very few escape

Very few people have escaped some of these tooth troubles, despite the daily brushing. The ordinary tooth paste does not dissolve film, so the tooth brush has left much of it intact.

Dental research has for many years sought a way to fight this film, and the way has now been found. Many clinical tests have amply proved its efficiency. And now leading dentists everywhere are urging its adoption.

The method is embodied in a dentifrice called Pepsodent. And millions of people are now enjoying its benefits.

Sent to any one who asks

The Pepsodent results are quick and apparent. Everyone who sees them will desire them. So, to spread the facts, a 10-Day Tube is sent to anyone who asks.

Pepsodent is based on pepsin, the digestant of albumin. The film is albuminous matter. The object of Pepsodent is to dissolve it, then to day by day combat it.

A new discovery has made pepsin possible. Pepsin must be activated, and the usual agent is an acid harmful to the teeth. But now a harmless activating method enables us to constantly fight the film-coat in this way.

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how the teeth whiten as the film-coat disappears.

Do this now, for few things are more important. The results may be life-long in extent. Cut out the coupon so you won't forget.

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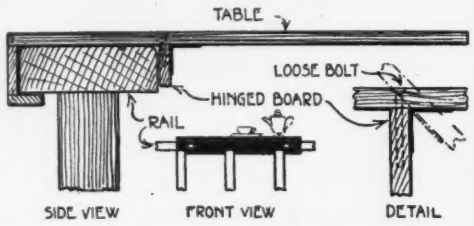
SAVE OVER HALF

Sliding Table that Fits Over the Piazza Rail

IN the summer tables are always in use on the piazza, but inconvenience is sometimes experienced in disposing of them or in placing them to advantage in the narrow confines between the rail and the house. The table here described fits on the buttress rail, can



Where the porch is crowded a piazza table will be just the thing on which to serve luncheon

be taken off instantly, and will slide to any position along the rail.

Build a flat table the desired size, and nail or screw a piece of wood along the back edge and at right angles to it. Then nail a second narrow strip at right angles to the first one, and it will form a sort of hook which will fit under the back edge of the rail.

Fit this on the rail and mark on the under side of the table where the near edge of the rail comes. Turn the table over and hinge to it a narrow board, as shown, which will fold inward. Turn it down at right angles and bore a hole through the table and this board at each end. A flat-headed bolt slipped down through each hole will keep this hinged board in rigid position and in this way will support the table on the rail without a load causing it to tip. It can be slid to any desired point and may be removed by taking out the bolts, folding back the hinged board and lifting the table off.

A Lawn-Roller that You Can Make at Home

ANY one having the care of a lawn will know that when the frost leaves the ground in the spring the ground is very lumpy. If the lumps are not rolled down at once the lawn will be rough all summer. An inexpensive lawn-roller can be made at home by following these directions:

Obtain a length of tile sewer-pipe, the size desired for the roller.

A tile pipe of 12 to 24 in. diameter will usually serve the purpose. Set the tile on end, small end down, on a wooden platform. Through a hole bored in the platform insert a 1-in. round iron bar, long enough to project beyond the ends of the roller a sufficient distance to provide bearings for the handles.

Make a wet mixture of concrete, proportions 1-2-4, which means 1 part cement, 2 parts sand, and 4 parts small stone or gravel. Place the bar exactly in the center of the tile, and pour in the concrete mixture up to the swell or

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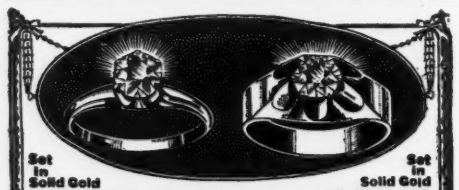

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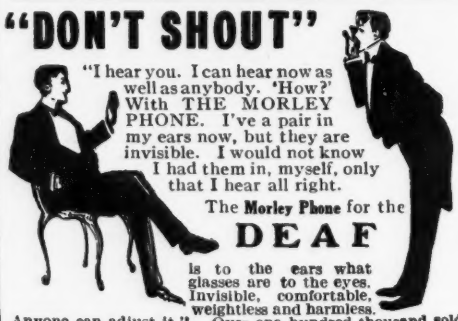

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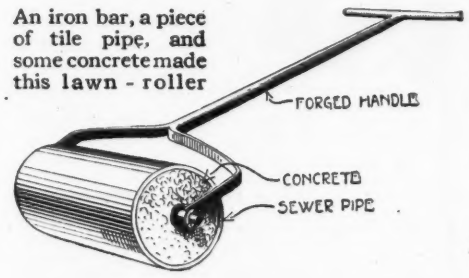
bell of the tile at the upper end. Allow the concrete to set for about ten days, when the roller may be turned on one side and the bell of the pipe may be chipped off with a cold chisel and hammer. Attach a forked handle as shown in the illustration. Your blacksmith can make it for you at small expense. As the axle is a fixed part of the roller, the forked ends of the roller handle are provided with holes, in which the axle can turn.

To avoid friction on the ends of the roller it is well to place a couple of washers on the axles at either end, then slip the handle forks over the axle and place another washer outside at each



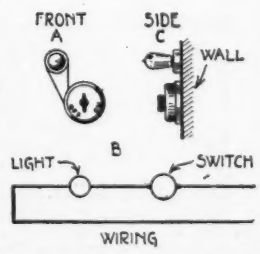
An iron bar, a piece of tile pipe, and some concrete made this lawn - roller

end. Bore a small hole through the axle just outside this washer and place a cotter-pin through it to hold the handle in place. A roller 18 in. in diameter and 2 ft. long will weigh about 500 lbs. Use a smaller-size sewer-pipe for a lighter roller, or place several small pipes inside the large one, and pour the concrete around them; these will form hollow spaces inside the roller and lessen the weight of the lawn-roller.—MORTIMER V. TESSIER.

Did You Forget to Put Out the Cellar Light?

WHY get a reprimand from your economical wife for forgetting to turn off the cellar light, when you can avoid it and save money on your electric-light bill?

Purchase a porcelain wall socket, place it alongside or over the wall switch, as illustrated. Using the single-pole system, you can fasten one wire to the turn-off switch and twist the other on the one you loosened. Then fasten the first to the screw, as in *B*. To make this a series of two lamps, you must use 60-volt lamps at each end, with about 15 watts for the best results.



You can't forget to turn off the cellar light if it is connected up in this manner

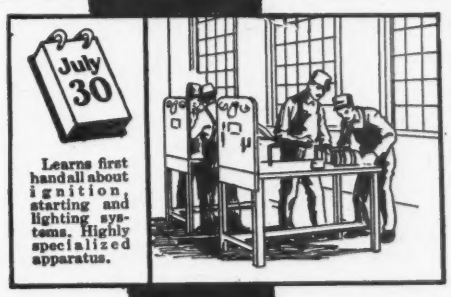
Color the kitchen lamp red to attract your attention and remind you to turn it off. This arrangement is very simple and it can be installed by any one.

To people with forgetful minds, such an invention as the one described above is of real monetary value.

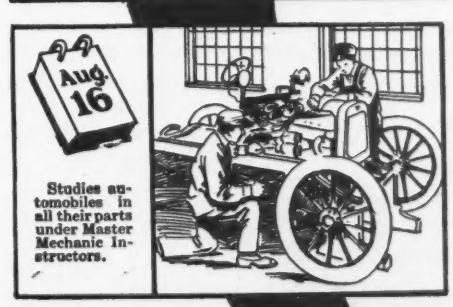
How Rahe Trained Tom Cooper to Be A Big Success in Only 7 Weeks

Tom Cooper enrolls in the Rahe Auto & Tractor School.

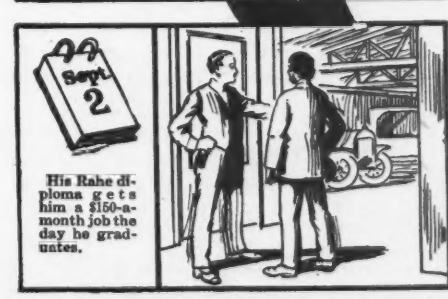
Works with his own hands in the best equipped shops ever used for training purposes.



Learns first hand all about ignition, starting and lighting systems. Highly specialized apparatus.



Studies automobiles in all their parts under Master Mechanic Instructors.



His Rahe diploma gets him a $150-a-month job the day he graduates.

Tom Cooper owns his own garage and repair shop.

How Tom Cooper Won Out

CHAPTER 1.

TOM COOPER lived in a small town. He had tried several jobs, but none of them suited him. One day he read about the great Rahe Auto & Tractor School in Kansas City where any man from 16 years up, could learn the Auto and Tractor Business in 6 to 8 weeks. Over 30,000 men, thousands of them of Tom's own age and station in life were Rahe trained men, and numbered among the biggest and most successful men in the Automotive Industry. They were making good, they had found success. Tom began to think. "If I stay here, what will I be earning 5 years from now?" he asked himself. "And how much money will I be getting if I go to the Rahe School and become an expert on autos, tractors and aviation?" He took a train for Kansas City.

CHAPTER 2.

The very day he arrived Tom Cooper enrolled as a student in the Rahe Auto and Tractor School. He found he had no dull books to wade through. He set to work at once in modern machine shops that were to be his school rooms. His instructors were wide-awake, Master Mechanics. Every possible kind of tool and machine was there for him to use with his own hands and men who knew all about them explained everything to him. At the close of his first day he had learned what made motors run and why some wouldn't run. For the first time in many days Tom was pleased with his work.

CHAPTER 3.

Inside of a month Tom found he knew most of what there was to know about motors. He found every kind of equipment there was to know about. And he found that it was easy to learn. It was one of the few things he had ever done that he liked. Each day his training took in new work until the facts about autos, tractors and aviation were learned, through actual practice. As Tom put it, he was sure "headed right."

CHAPTER 4.

The more Tom Cooper learned about the automotive business, the more his interest in the work grew. The time went by so pleasantly that almost before he knew it he was in his last week, learning how to manage a garage and by that time had decided that some day he would have a business of his own.

CHAPTER 5.

Before the end of the second month Tom graduated. He was now a Rahe trained man. "Here's a job for you at $150 a month to start," said Mr. Rahe, as he handed Tom his diploma. Tom went to see the garage mentioned. "Yes," said the owner, "Mr. Rahe just called up about you. His O. K. is enough for me—the job is yours."

CHAPTER 6.

Cooper worked at this job four months when the big chance he was looking for came. Best of all it was in his own part of the country. He went into the garage business for himself. Today Tom supports his wife and mother and has a mighty nice bank account. As he says himself, "I am my own boss and doing well. Rahe trained me to be successful from the start."

Here is a coupon that will open to you the same door of opportunity into which Tom Cooper walked to success. A special low tuition rate for Full Life Scholarship now if you fill out and send it at once to

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Brace Up and Build Yourself Up

There isn't any doubt that **you can do it,** if you just WILL to do it, and go about it the right way. You can get rid of the constipation, indigestion, dyspepsia, biliousness, headaches, or other chronic ailments that are destroying all your chances of success in life; you can break away from any habits that are undermining your constitution and holding you back; you can strengthen your vital organs, build up your muscular system, sharpen your wits, and become well and vigorous again—just as thousands of other sickly discouraged men already have succeeded in doing. Patent medicines and druggist's dope didn't work a cure for them and won't for you. Pills and potions will only empty your purse and put money into the pockets of their promoters. **Take the right road.**

Let Nature Help You Do It

I have spent my lifetime studying out Nature's ways of restoring lost health, strength and energy, to weakened, devitalized, unfortunate men. I have learned the secret of the wonderfully recuperative, rejuvenating power she exerts, when a few of her simple laws are known, observed and followed. It is the force on which every surgeon and medical man depends in the treatment of his most difficult cases. It never fails, when conditions enable it to be efficaciously applied.

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Strongfortism is the system of living life in Nature's way—as it was meant to be lived—and of getting the greatest enjoyment out of it. It is the system which has restored vigorous health, strength and energy to thousands of my pupils, many of whom had given up all hope of ever getting back the health they had lost. What Strongfortism has done for **them** it can and will do for **YOU,** no matter what your present condition or what causes brought you to it. **Give Nature a chance to build you up.** Strongfortism will show you how.

Send for My Free Book

You will find **"Promotion and Conservation of Health, Strength and Mental Energy"** the most interesting book you ever read. It will tell you all about Strongfortism; how YOU can build yourself up, just as my other pupils have done and are doing in all parts of the world, make a MAN of yourself, with red blood, pep and energy that will give you a fair chance to make a big success of whatever you undertake. No patent medicines to buy; no complicated, expensive apparatus required; you can practice Strongfortism and get all the benefit of it in the privacy of your own home, if you like, without in any way interfering with your present occupation. Don't put off sending for the book—IT'S FREE. **Write today.** Fill out the coupon below and enclose three 2c stamps for packing and postage, and I will mail you a copy at once, together with a special letter on the points in which you are specially interested.

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...Headache	...Constipation	...Poor Circulation
...Thinness	...Biliousness	...Skin Disorders
...Rupture	...Torpid Liver	...Despondency
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...Neuralgia	...Nervousness	...Lung Troubles
...Flat Chest	...Bad Habits	...Increased Height

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Age..... Occupation.....
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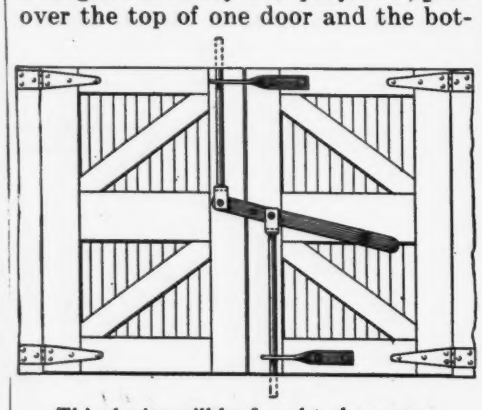
City..... State.....

An Easily Operated Lock for Garage Doors

THE usual style of latch for garage and other double doors that are exposed on one side to the weather, allows the doors to warp, which makes them difficult to fasten. To avoid this, the fastener shown in the sketch was devised. The device consists of a 16-in. long, 2-in. wide, and ¾-in. thick steel lever working on a pivot on one door, a washer being placed between the door and the lever. At 4 in. on the right- and left-hand sides of the pivot, holes are bored. Two U-shaped pieces are then made out of flat iron bars that are of sufficient size to slide easily along the bar.

Two 1 in. round bars are cut to such a length that they will project 1½ in. over the top of one door and the bottom of the other. One end of each bar is then welded to the center of each U-shaped piece, a hole being bored at a right angle to the side of the piece and through the legs. A rivet is then inserted through the hole in the round bar and legs of the U section. The rivet should be of sufficient tightness to allow the bar to move freely up and down. Make a guide out of a piece of a rectangular iron bar, part of which should be twisted while hot at a right angle. A hole of sufficient size to slip over the top of the plunger is bored in one end, and screw holes put through the opposite end. This bar holds the plunger in a vertical position.



This device will be found to be a practical and convenient door fastener which gives satisfaction in all weathers

To prevent wear on the holes in the casing and sill, it is best to have a short, flat bar of steel with a hole bored in its center and also screw holes near its ends, screwed to the top casing and sill of the door. A guide is also to be made for the bottom plunger. Both the top and bottom plunger rods should be tapered slightly at their ends, so that they will easily enter the holes bored in the casing and sill. When the handle of the lever is in a horizontal position the plunger rods are level with the top and bottom of the doors.

A rabbet nailed to the outside of one door and extending over the joint, makes a storm-proof joint. For entering the building, it is customary to have a small door made in the large door opposite the one carrying the lever.—W. S. STANDIFORD.

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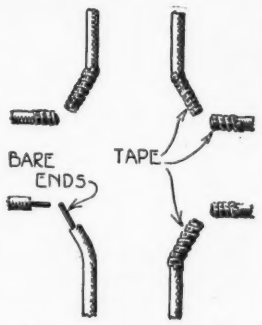
Safety in Working with Live Wires

SOMETIMES it is necessary to cut a live wire and splice in new wiring, or do other work at a time when it is impossible or impracticable to turn off the current. In doing such work there is great danger of bringing two sides of the circuit together and making a "short" and so blowing out the fuse. This can be avoided by a little care. Cut one wire at a time, and as soon as one is cut wrap the ends with several thicknesses of tape. Then cut the other and do the same thing. Tape the ends of the wires to be spliced in, that is, the ends opposite those to be spliced. Splice in one end and tape it up carefully. Then remove the tape from the next pair of ends to be spliced and splice up, and so on. Thus there will never be any bare wire that can cause a short circuit.



Live wires can be safely spliced if all ends except those being spliced are carefully covered up

Something About Vaseline that You Don't Know

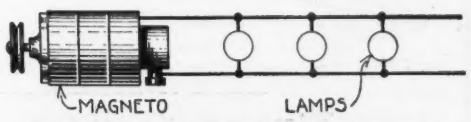
WHY pay a painter eight dollars a day when you can do the job yourself, you ask triumphantly as you put on your overalls and mix up the paint.

But when you've finished you find that you splashed paint on the doorknob, hinges, light fixtures, etc., and that it won't come off.

Here is where the professional painter gives you a hint: Smear vaseline on all the parts that you don't want painted. Then when you have finished the job, wipe it off. Any paint that you may have dropped when you were flapping your brush in the air will come off too.

A Low-Tension Magneto Becomes a Dynamo

LOW-TENSION magnetos, formerly used in many automobiles for ignition but now seldom seen, make very good little dynamos for running small lamps. No change whatever is necessary, the only trouble being to discover what lamps are most suitable. With the magneto running at high



Connecting up lamps in parallel for running with current from low-tension magneto

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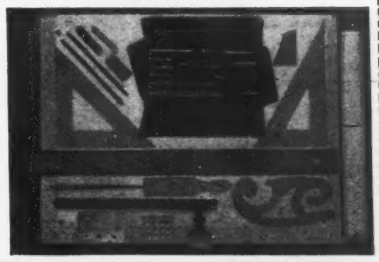

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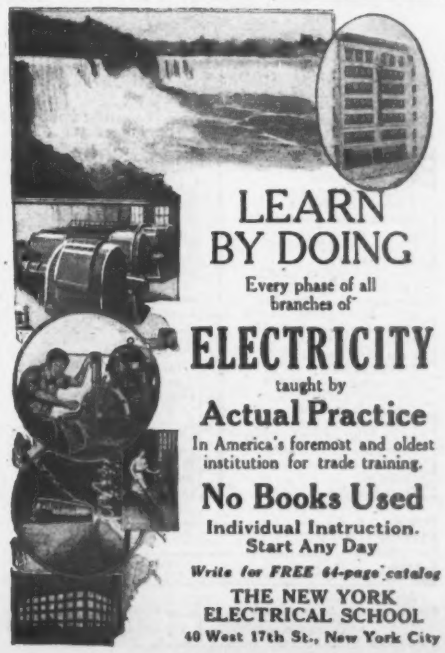

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speed, try it on several lamps of, say, 6 volts and about 6 candle-power. Connect the lamps in parallel. By a little experimenting you can find out what lamps will give the best results. Be careful to try the higher-voltage lamps first, for the low-voltage lamps might burn out. Or, if you have or can obtain only low-voltage lamps, less than six volts, run the machine very slowly at first, and if you find that there is current to spare you can use lamps of greater capacity. With the lamps in parallel the light is less affected by fluctuations in speed than if they are in series.

A Novel Way to Oil Bearings and Pulleys

ANYTHING that tends to cut down the cost of manufacturing and reduce accidents is essential in shops and factories these days.

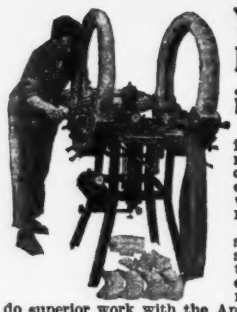
The oiling device shown in the illustration will save time and money. Any pulley or bearing can be reached with it by the workman in perfect safety without the use of the cumbersome and dangerous stepladder.

The stepladder is a thing of the past for oiling overhead shafting. This new oiler does it from the floor without danger of accident to the workman

There is nothing complicated about making this oiler, and the illustration shows every part clearly. Three screws hold the oil-can in place and its bottom is pressed by the operator pushing down on the handle which compresses the block against the bottom of the can.—F. E. LEITCH.

To Keep Small Boats from Fouling Their Moorings

DUE to the rise and fall of the tide, small boats, when moored with ropes in the ordinary way, have a tendency to foul under the dock or between the piles to which they are tied. This fouling can be avoided by adopting the simple method shown on page 123.



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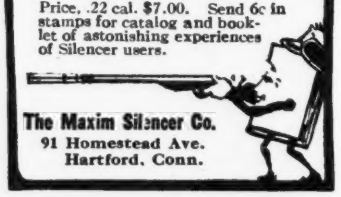

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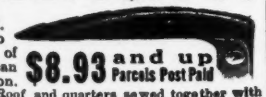

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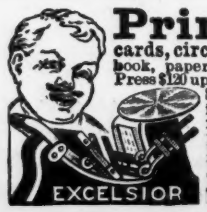

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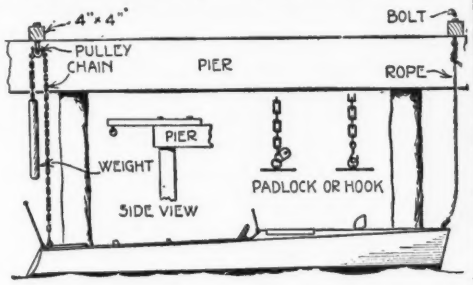
First fasten two planks, say about 4 in. by 4 in., to the pier and allow them to project about 5 or 6 ft. from the edge of the pier. From the end of one plank suspend a pulley with a groove large enough to take a light chain. The chain need not be a heavy one; ¾ in. is large enough. Provide a weight, such as those used for windows, and fasten to one end of



The weights keep the moorings taut, but still allow the boat to rise and fall with the ebb and flow of the tide

the chain. The other end of the chain is fastened to the bow or stern of the boat, with either a hook or padlock, as shown.

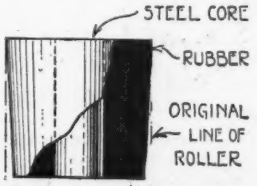
To the other plank fasten a rope, one end of which should be fastened to the other end of the boat. The rope should be long enough so that when the tide is lowest, it will be a trifle slack. The chain, on the other hand, should be long enough to allow the weight to swing free, thus keeping the chain taut at all times. The weight, of course, should not be so heavy as to strain the rigging.

The weight, exerting a steady pull on the chain, keeps the boat in a line between the two planks and prevents it from drifting to either one side or the other.—FRANK W. HARTH.

Rubber Plugs for Testing Radiator Leaks

WHEN testing automobile radiators for leaks it is the usual custom to plug up the water connections with large stoppers, and pump in air. These plugs are generally made of wood, which split, chip, or wear out so that tight plugging is impossible. To overcome this annoyance the following idea will be found useful:

Saw off sections of a clothes-wringer roller long enough to make stoppers for radiator use. Use a hacksaw, as the usual roller is built upon a steel core. The rubber covering will be found sufficiently thick to be tapered to fit the opening. The tapering may be done with a coarse file, and an emery cloth should be used for smoothing down.



Rubber plugs are much better than wooden ones for testing leaky radiators

Such stoppers will stand hard usage better than wood, and if tapered true, they will always make a tight joint.

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Johnson Motor Wheel
AND POSITIVE TRACTION

The Twin-Cylinder Johnson Motor Wheel takes narrow paths, holds the roads and avoids obstacles with the greatest ease. The illustration above shows a rider passing between a stump and a boulder and another crossing a stream on a plank as surely and safely as on a bridge.

Positive Traction is very important in any vehicle, particularly so in a machine like a bicycle which requires some skill in keeping balanced.

Every bicycle rider should investigate this wonderful little power plant. Any ordinary bicycle can be changed into a Two-Cylinder Motor Bike by simply replacing the bicycle rear wheel with a Johnson Motor Wheel. Not until this has been done will you realize the many conveniences and pleasures which you are now missing.

It does not detract from the graceful appearance of the wheel and it will travel 150 miles on a gallon of gasoline. It will carry a rider weighing 200 pounds as easily as a boy weighing 90 pounds.

The Johnson Twin is the only Two-Cylinder Motor in the world to drive a bicycle.

Ask us to mail you today illustrated booklet containing very interesting detailed description of the Johnson Motor Wheel.

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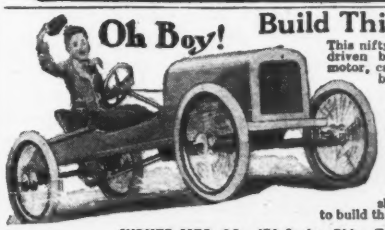

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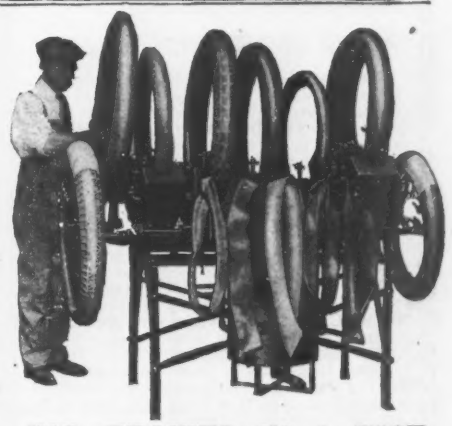

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Concrete for Economy on the Farm

By John Upton

THE first question the farmer will ask about concrete is apt to be in regard to the amount of material required and the proportions to use in mixing the concrete.

For low foundation walls, small buildings, grouting for floors, and other work not requiring much strength, a mixture of one part cement, three parts sand and six parts gravel or broken stone, will be right.

Concrete saves the farmer a lot of money these high-cost-of-living days

Sand means any grains that will passthrough a sieve with meshes ¼ in. square. Larger than this, the material is called gravel. You may wish to use the gravel and sand mixed as taken from the pit. This can be done if one part cement to six parts of the pit gravel and sand is used for the above work.

A good medium mixture for cellar walls, barn foundations, retaining walls, walks and single course floors, is called, one: 2½: 5, or one: 5. A better and stronger mixture is needed for engine foundations, tanks, cisterns, and watertight work, and the proportions may be 1: 2: 4, or 1 to 4.

For work subject to strains, as columns, fence posts, reinforced concrete and top coat for floors, use one part cement to three parts gravel and sand.

If you wish to figure out the amount of material needed, this table will help:

Materials for 1 cu. yd. of Concrete

Proportions			Barrels in 1 cu. yd. of Concrete		
Cement	Sand	Stone or Gravel	Cement	Sand	Stone or Gravel
1	1½	3	2.	3.	6.
1	2	4	1.5	3.1	6.25
1	2½	5	1.25	3.25	6.5
1	3	6	1.10	3.30	6.60

A barrel, or four sacks of cement, is 3.8 cu. ft., and a barrel of sand or gravel means the same amount. A bottomless box or frame 10 in. high by 2 ft. 3 in. by 4 ft. will hold two barrels. Such a frame may be set on the mixing platform and lifted off after it is filled, leaving the gravel ready for the cement.

For cellar and basement walls the following table gives the amount of material needed and the thickness that the walls should be for different heights.

Height of wall	Thickness at bottom	Thickness at top	Cement for 10 ft. of wall	Sand for 10 ft.	Gravel for 10 ft.
ft.	in.	in.	bags	cu. ft.	cu. ft.
6	6	6	6	14	29
8	10	8	12	29	58
10	15	10	25	60	120

I have found in actual practice that a good stable floor can be made by using a barrel of cement for each 50 sq. ft. of floor, where there are gutters, as in a cow stable, and for a plain floor one may get 60 ft. to a barrel.

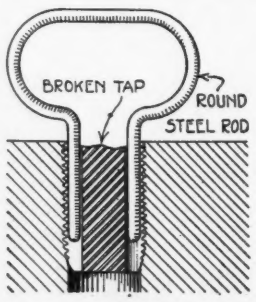
In building foundation walls by using large stone and putting in all there was room for, I have made 40 cu. ft. of wall with a barrel of cement, but this was in a thick wall where large stones could be used to good advantage. For most work it is best to figure on about 1 cu. yd., 27 to 30 cu. ft., for a barrel of cement when the leanest mixture is used, and about two barrels of cement for 1 cu. yd. of the richest mixture that is commonly used.

For economy the sand, gravel, and stone should be of varying sizes, for the coarser they are the less of the finer materials—cement and sand—will be needed to fill the spaces. If you want to build a good wall with as little cement as possible, you should use as large stones as you can place in the forms, and leave an inch or so outside of them for the mortar, and you should use as many of them as possible while leaving room between them for mortar.

A New Tool for Recovering Broken Taps

WHEN an amateur machinist happens to break a tap below the surface of the metal, he is usually puzzled for a time to find a suitable method to remove the buried end. The tool shown below is simple to make and will prove a great help in such emergencies.

Bend a piece of round steel rod in the manner indicated and harden it. The legs should be slightly smaller than the diameter of the hole.



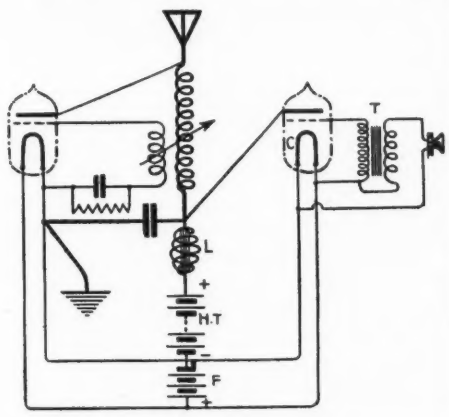
Removing a broken tap isn't such a hard job if you know how to do it

When the tap breaks, first squirt kerosene liberally into the hole. Then insert the legs of the tool between two opposite flutes and shove them down as far as they will go. This gives a firm purchase and by turning it anti-clockwise the stub can be easily unthreaded and brought out.—WINDSOR CROWELL.

A War-Time Radiotelephone Transmitter

HOW good wireless telephony was rendered possible during the war, was explained in a speech recently delivered before the Institute of Electrical Engineers in London by Major C. E. Prince of the R. A. F.

The circuit is shown in the accompanying figure, in which P is the power, and C the control valve, L the choke coil, T the microphone transmitter, H T the source of high-tension supply, and F the filament battery. The anodes of both valves draw their high-tension direct-current supply through the choke winding, and as long as the microphone is quiescent the output and general behavior do not differ from those of a power circuit considered as a plain one-valve oscillator. When, however, variations take place in the



Radiotelephone circuit with the antenna in the circuit of a vacuum-tube oscillator and another tube for a modulator

controlling valve anode circuit at speed frequency, very large surges are set up in that of the power valve, which may approximate to the original high-tension d. c. potential, and so sweep the output from nearly double its steady value to almost zero. Choke control proved eminently successful for air working, and no other system of working survived in competition with it. There are no critical adjustments anywhere. Almost every constant can be changed within quite wide limits, and though it may thus be caused to work more or less efficiently, it never reaches the point of complete failure.

This circuit is one of the most convenient for use in small power telephone sets and ma. be used to advantage with small aerials at land stations as well as on airplanes.

A Wireless Telephone in a Tree-top

A RADIO station in Los Angeles, having a unique situation was designed by thirteen-year-old Charles Schuessler. It is located in the top—or what used to be the top—of a huge pepper-tree. The building was constructed of old piano and dry-goods boxes. The young builder's feat will

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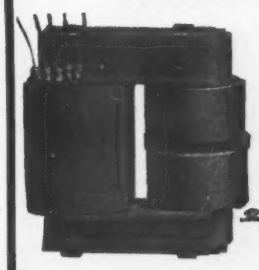

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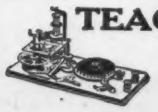

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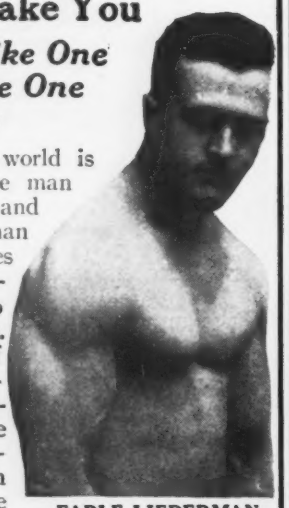

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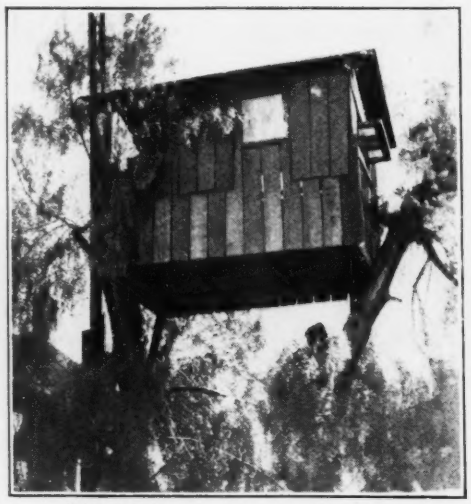
interest other young Americans who are prevented from taking up amateur radio work on account of lack of house room.

Two great branches having a spread of 7½ ft. at an approximate height of



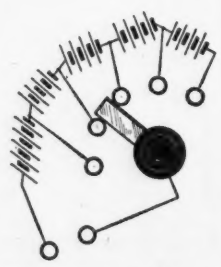
This is the way an amateur has solved the question of high rents

15 ft. from the ground, form the foundation. The office compartment is 5 by 5 ft., allowing a porch or landing, 2½ by 5 ft. Windows at ends and sides afford ample light and ventilation. The aerial mast, only part of which is shown in the picture, has a length of 56 ft. 3 in.

In connection with the establishment is a "shocker" for conveying messages to undesirable visitors, to get out. It consists of two large tin plates fastened to the floor of the landing and connected to the electrical apparatus by wires run under the floor. By turning on the juice the operator generally succeeds in ridding himself of an unwelcome caller.—E. B. R.

Precaution Against Shorting Batteries

WHEN a rotary switch is employed to cut batteries into a circuit at the will of the operator, great care must be taken to space the contact points at such a distance that the blade of the switch does not touch them both or any two at any one time. Not to do so would short circuit some of the cells with the switch arm, as is clearly shown in the sketch. The life of dry batteries, especially small flashlight batteries, is materially shortened when this occurs. Sometimes amateurs are careless about this matter. On the other hand, if the switch arm does not short some cells the circuit opens. You must balance battery cost against clicks and bats in the ear and decide for yourself.—E. T. JONES.



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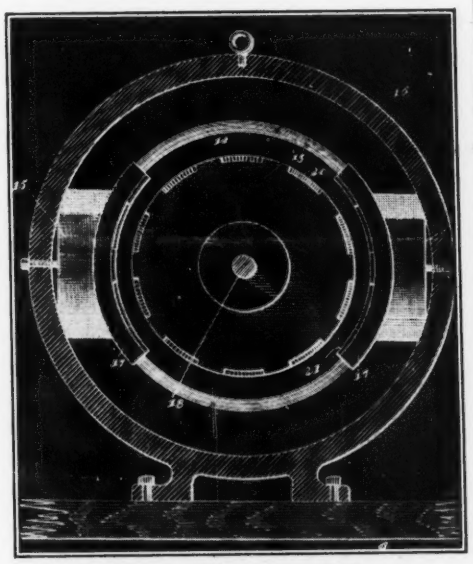
A Direct-Current Generator with No Commutator

THE writer has recently invented a d. c. generator with no commutator or collector rings. This improvement will provide a generator especially adapted for radio-telephonic and -telegraphic use, and for sustaining the filament and plate potentials of vacuum tubes. The commutator type d. c. generators introduce current fluctuations. A storage battery is not always financially practicable when a plate potential of several hundred volts is desired, and such high-plate potentials are becoming increasingly common in radio work.

My generator is an inductor type. The essential parts are: two stators, supporting the armature and field windings, a rotor, and a frame. In the drawings which are reproduced from my patent, Fig. 7 is a vertical section through the generator. In Fig. 8 is shown a front view of the rotor and shaft. A front or face view of the high-voltage machine is shown in Fig. 9.

The rotor is built up of laminations of magnetizable material, with radial projections at regular intervals. These



Vertical cross-section of a high voltage generator which has no commutator. (Fig. 7 of inventor's patent specification)

form spiral ribs about the peripheral surface of the rotor, as indicated by 14. These ribs are the active pole pieces and are arranged in a spiral form so as to feed or screw the magnetic flux from one end to the opposite end, parallel to the shaft. The poles numbered 15 are supported by the frame 16 and may be self or externally excited, as desired.

The pole faces of the stator are curved on an arc of a circle whose axis is the shaft 18. They are grooved on their concave faces, as shown in Fig. 9 at 13. These grooves are at right angles to the shaft and contain the armature windings 13. These armature coils are held in place by the pole pieces or shoes 21, which are spiral to the shaft. These shoes are placed at an angle opposite to that in which the shoes of the rotor are placed.

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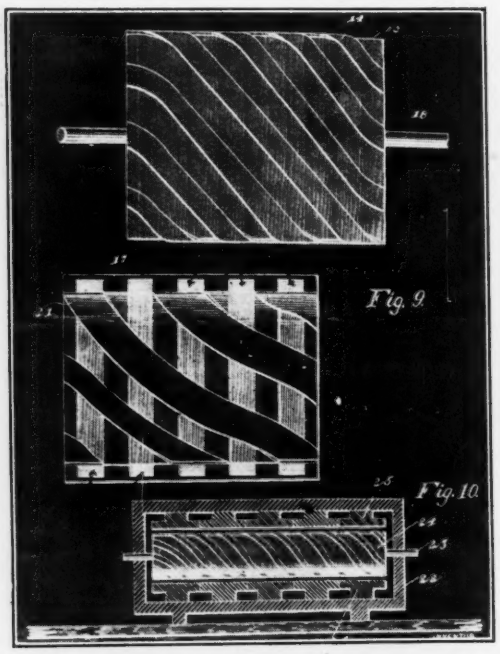


At top, Fig. 8 shows spiral ribbed rotor which screws the magnetic flux past stator of Fig. 9. Fig. 10 shows section of assembled generator

Since the spiral projections 14 on the rotor are inclined at an opposite angle to the projections 21 on the stator fact, it is evident that these will be crossing each other during the rotation of rotor, and the projections are so spaced that each shoe of the rotor will, at any one time, be cutting a plurality of shoes of the stator.

The lines of force are always moving parallel to the axis of rotation of the rotor and moving from one end to the opposite end, depending upon the direction of rotation. This gives rise to a revolving magnetic field moving parallel to the axis of rotation. In this parallel movement the magnetic flux traverses the armature coils which are at right angles to the axis of rotation of the rotor and magnetic field.

By lengthening the rotor and paralleling the stators, as shown in Fig. 10, sufficient series turns may be added to the armature winding to deliver several thousand volts.

This machine is therefore adaptable to sustaining the high-plate potentials used in radio telephone and telegraph apparatus.—O. S. Mock.

Constructing a High-Tension Wireless Transformer

THIS transformer is designed to operate direct from the city lighting current of 110 volts, 60-cycle a. c., without any external resistance. The necessary materials for construct-

ing it are usually found in the experimenter's laboratory or at the amateur's best friend the junkman's. The materials required are 1 sheet of silicon transformer steel or stove-pipe iron, 3 by 4 in.; 2¾ lbs. of silk-covered copper wire No. 36; 3 lbs. of DCC copper wire No. 16; 3 ft. lamp-cord.

The primary coil is wound on a core 1¼ in. in diameter. It consists of 725 turns of No. 16 wire. This coil may be wound by hand, but care should be exercised to insulate each layer of wire from each other. Bring out taps at 600, 625, 650, 675, 700, and 725 turns. These taps are to be taken off with lamp-cord or any other rubber-covered stranded wire.

The secondary coil is made up of 20,000 turns of No. 36 SC wire wound in layers of 300 turns each. First make a core of empire cloth or oiled linen by shellacking (not gluing) the ends of the cloth together to form a cylinder 1¼ in. in diameter. Then fasten one end of the wire to a piece of lamp-cord that has been flattened with a hammer.

Then wind on 66 layers of wire having 300 turns in each layer. Between each two layers place a strip of waxed condenser paper for insulation. When this coil is finished it may be impregnated with bee's-wax or oil.

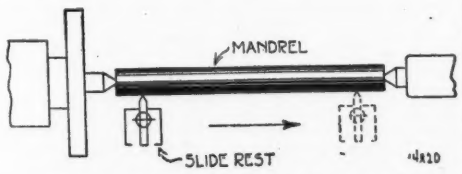
The iron sheet is cut into strips 3½ by 1 in., and 5½ by 1 in. in equal number. These strips must be perfectly flat and even, or they will not fit well. Build up one side and one end by placing the strips together at right angles and build it up 1 in. thick. After the two coils are thoroughly taped and the tape brought out, slip them on this iron core and complete it.

Mica may be used to insulate the coils from the core, but this is not absolutely necessary if the coils are well made and taped.

A suitable condenser may be made from 30 5 by 7 in. photo-plates with tin-foil between them.—EARLE L. RUSSEL.

Setting Slide-Rest for Parallel Work

WHEN a lathe slide-rest has to be set for parallel work, it can be easily done by putting between the centers a mandrel that is known to be true, and running a sharp-pointed tool



This is a simple method of setting a slide-rest for parallel work in a lathe

along in the slide-rest. The tool may be started at one end of the mandrel as close as it can be set without touching. If the rest is truly set, the tool will travel without touching the mandrel and without moving farther from it. If it does not, the necessary change in setting is plainly indicated.

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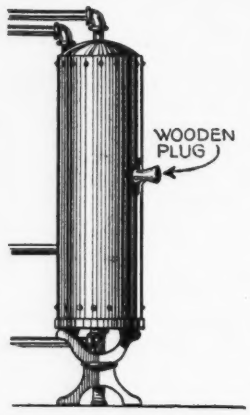
A Wooden Plug for Boiler Leaks

By W. S. Standiford

THE domestic apparatus that contributes so much to the home happiness and comfort of the human race will occasionally break down and upset the smooth running of the household; the breakdowns usually occurring at the most inopportune times.

The present article tells how one emergency repair was made. A large kitchen-range boiler in a boarding-house exploded on a holiday morning, a circular hole ¼ in. in diameter being punched in its side, near the center. Through this, steam and hot water escaped and the floor was flooded. The landlady was frantic, as no plumber could be found and it was necessary to have plenty of hot and cold water for culinary purposes, with fifteen boarders in the house to be fed.



Suppose your kitchen boiler sprung a leak. Could you make an emergency repair until the plumber came?

One of the fifteen, I was called upon to decide what could be done to keep the boiler in operation. The first thing I did was to shut off the cold water by means of the water-pipe stop in the cellar. This prevented any more hot water from flowing onto the floor and also shut the water entirely off in all faucets in the house. A piece of pine wood 3 in. long and ¾ in. thick, was whittled, one end being tapered so it would enter the hole easily. The plug was then driven half-way into the boiler by means of a hammer; and a 2-in.-wide strip of muslin was tied around the boiler and over the plug to hold it in position. This was found to be unnecessary, as the wood projecting inside the boiler swelled so quickly in the remaining hot water that it locked tightly into place, and no further leakage occurred. The illustration shows the boiler with the plug in place.

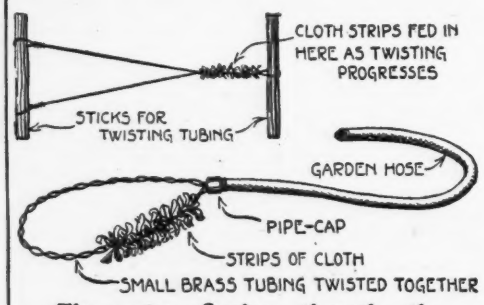
The boiler had undergone hard usage, the fire being kept burning day and night—hard coal being used. As the fire was banked at night, the boiler had no chance to cool off, the result being that steam issued with the water from the hot-water faucet when it was turned on. The use of a pine plug or peg for an emergency of this kind can be depended upon.

The boiler with its plug was in use two weeks, giving its owner ample time to purchase a new one.

It Makes Automobile Washing Easier

HERE is a homemade brush that will be of much help when washing the car. It screws to the end of the hose, and washes the surface of the automobile with a steady supply of fresh water. This brush consists of two lengths of small copper or brass tubing such as is used for gas installations, a supply of old rags, and a pipe cap to fit the end of the hose.

Tear the rags into strips an inch or so wide. Secure the lengths of tubing



The water flowing through the holes of the tubing into the rags makes an excellent cleaning medium

to a support as shown and the two other ends to a short stick a few inches apart. Then with the tubing held taut the stick is revolved slowly, twisting the two tubes together, the rags being fed between the tubes as they are twisted so that a quantity of the cloth strips is securely held in place. This process is continued until about a twenty-inch length of the tubing has been twisted. The ends are then cut off with a file and, after bending into a loop, inserted through a hole drilled in the pipe cap, and soldered there, the ends of the tubing projecting enough to avoid danger of getting filled with solder.

The brush is completed by drilling very small holes through the tubing alternately every inch or so, so that the water when turned on will be forced out and along the mass of cloth strips.

How to Straighten Warped Disk Records

SOMETIMES through neglect disk phonograph records are left in the sun or a very warm room, and not kept perfectly flat. They become warped, preventing the attainment of the best results, and if too much warped, they cannot be played at all.

I have used this method and found it worked with perfect success:

Place the bent record in the hot sun or in the oven of the cook-stove, watching it until it becomes very limber. While in this condition, place it on a marble-top table or plate-glass, pressing it firmly down with both hands, holding it for about a minute, until it gets hard again.

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A Lace-Cutter Made from a Safety-Razor Blade

VERY often intricate lace or silk cutting demands something sharper than a pair of scissors or a knife. A safety-razor blade is just the thing,

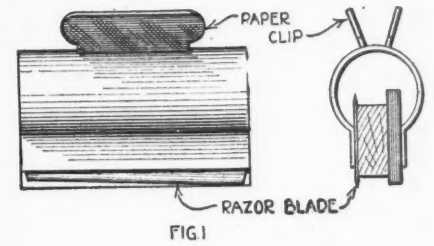


FIG. 1

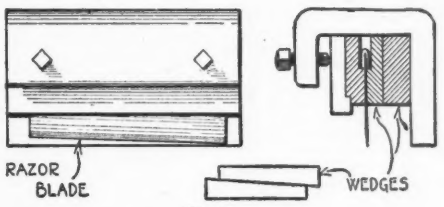


FIG 2

Use up the old safety-razor blades by making lace-cutters from them. Does this suggest other uses for old razor blades?

but the housewife doesn't like to use it for fear of cutting her fingers.

Two easily made and handy holders for different-type blades are shown in the illustration, which need no further description.

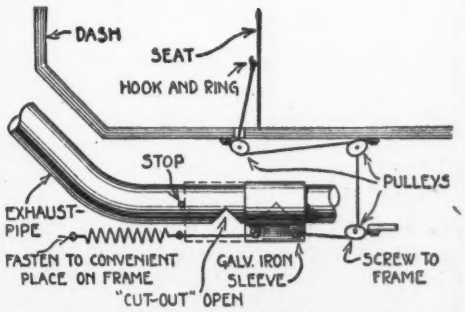
In both instances, when working, the blade should be slightly raised at the end before beginning the cut.

You Can Make an Automobile Muffler Cut-Out

NOWADAYS the low-priced car is not provided with a cut-out; in fact it is against the law in many states. It is necessary, however, to have one for testing the engine.

This provides a quickly constructed homemade device for releasing the excess pipe pressure and exhaust gases. It is light, efficient, and absolutely practical.

Procure a hack-saw and cut a V-shaped piece out of the exhaust pipe beneath the floor boards of the



If your car isn't fitted with a cut-out, make one from a piece of sheet-iron

driver's seat. Fit over the pipe hole a piece of galvanized sheet-iron bent round about 2 3/16 in. The sheet-iron is connected in the manner shown in the illustration. The result is a practical cut-out ready for use at any time.—P. P. AVERY.

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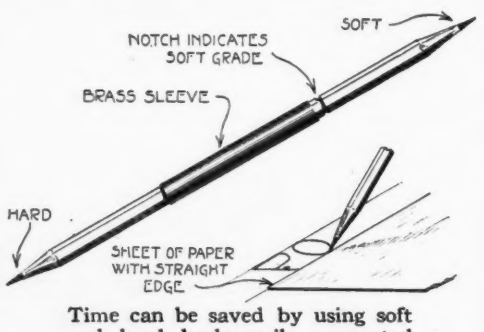
A Pencil Hard at One End, Soft at the Other

SOMETIMES a draftsman or artist has to use two pencils of different degrees of hardness, perhaps a hard one for ruling dimension lines and a softer one for putting in the figures or for lettering. When both are used alternately and both are the same in outside appearance, trouble is experienced and time is lost, due to getting them mixed.

If one is notched all around near the top, it can be distinguished easily, even by the sense of touch, without having to look at one every time it is picked up. If a third pencil of another grade is used at the same time, it may be given two notches.

When the pencils are about half used up, they may be fastened together by a light brass sleeve, as shown in the sketch, thus having both the hard and soft one always at hand, it being necessary only to reverse end for end. A notch should be cut in one as before.

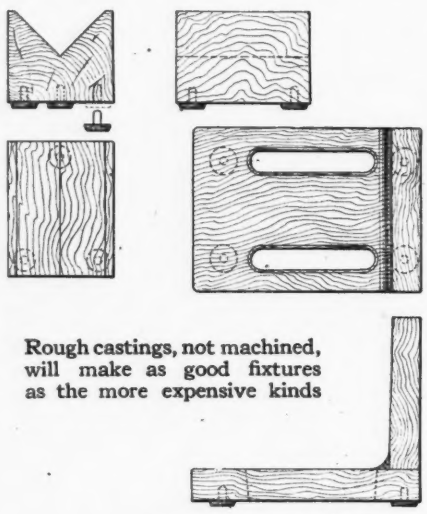
Before putting in lettering in pencil, it is customary to rule light lines to letter by, but time can be saved and a neater-looking drawing will result if a sheet of paper with a straight edge is laid upon the drawing and the letters put in, using the top edge of the paper as the bottom line of the lettering. It is impossible for the letters to extend below the paper as long as this is not allowed to move, but it should be held parallel with the edge to obtain speed in your work.



Time can be saved by using soft and hard lead-pencils connected together. Here is the way to do it

Angle-Plate and V Block for Rough Work

FOR a large variety of work not requiring extreme accuracy or smooth finish, rough castings not machined at all will make just as good fixtures as the more elaborate and expensive kinds, and they have the advantages of cheapness and quickness and ease of construction.



Rough castings, not machined, will make as good fixtures as the more expensive kinds

The illustration shows one of a pair of V blocks useful for holding shafting for spotting or drilling shallow holes or chipping keyways, etc. They may be made any convenient size. Three loose pieces are attached to the pattern as shown. These form a three-point support, and when the casting is at hand, they are quickly smoothed off with a file or disk grinding-wheel. The castings require no other work done upon them, though they should be reasonably smooth and free from fins.

An angle-plate is also shown. While the upright will only be approximately at right angles to the base, work of the character described above may be bolted to it and shimmed for drilling, spot-facing, etc. The slots are cored out, using green sand-cores, but allowing plenty of draft, as shown. A fillet must always be fitted into the corner of the pattern; this may be of wood, leather or wax.

Unlike the V block, the angle-plate here illustrated has four bosses; these are filed up so that the device will rest evenly on all fours when on the drill table or other plane surface. As in the first case, no other machining will be required, except perhaps drilling for clamp bolts.—H. H. PARKER.

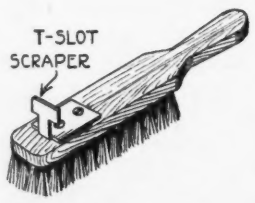
The Brush that Has a T-Slot Scraper

THEY say that necessity is the mother of invention, and the brush shown and described herewith proves the statement.

Practically all machine tools have T-slots in them at some point and this brush is used for cleaning out these slots.

The sheet-metal T-shaped piece on top of the brush cleans the heavy accumulation of dirt at one scrape, while the brush gets into the corners and removes all particles of dirt that are left.

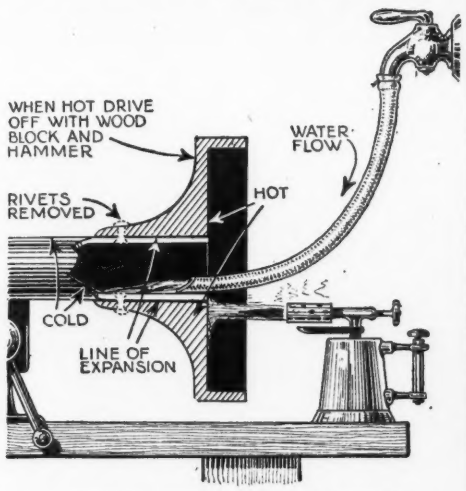
With this equipment the brush accomplishes a double purpose.—J. W. MOORE.



A little piece of T-shaped metal on top of your brush helps clean machine slots

Removing Brake-Drums from Axle Housings

IN repairing tubular axles or drive-shaft housings, it is hard to drive the ends from the main housing, even after the rivets are removed and every-



A novel and easy method of loosening brake-drums from the main housings

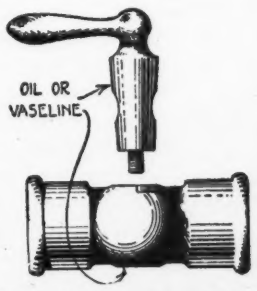
thing disconnected. Even with the housing held securely in a large vise and a pipe-wrench used, it is practically impossible to separate the parts.

To overcome this difficulty I have found the following method very valuable.

Clamp the housing securely in a bench vise. Light a plumber's blow-torch and, while this is getting warm, slip a piece of rubber hose over a water-faucet. Heat with the torch the part that is to be removed, then turn cold water on it as shown in the illustration. This will contract the parts sufficiently to drive them out.—P. P. AVERY.

Do You Know When Your Gas-Stove Needs Oiling?

EVERY one who has used a gas-stove has noticed how quickly they wear loose, so that they become sources of danger, as well as inconvenience, because a touch will open or close them. Of course the wear can be taken up by tightening the screw at the end of the plug, and wear can be minimized greatly by simply putting a little heavy oil or vaseline on the plug and the washer at the end of the plug, so that there is lubrication wherever there is friction. This applies equally to lighting fixtures. Often if a gas-tap is a trifle tight it will turn with a series of jerks, making it difficult to adjust the flame just as it is wanted. The lubrication will cure this.—HOWARD GREENE.



Vaseline or oil applied to the plugs of the gas-cocks will prevent looseness for a long time

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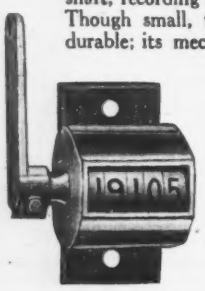

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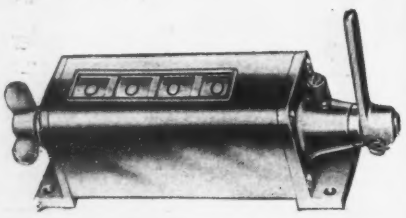

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Make Your Lampshades at Home

By Edna Purdy

THE parchment lampshades one admires in the shops cost considerable money. At a fraction of the cost they can be made at home.

Buy parchment paper, which comes in white rolls. Then decide what shape you wish your shade. If you want a flaring shape, cut a circle as in Fig. 1. This circle may be cut from cardboard and then traced on to the parchment paper, as shown in the picture.

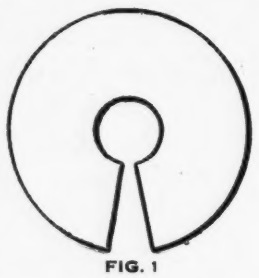


FIG. 1

FIG. 2

Fig. 1 is the outline for a flaring shade, Fig. 2 for a shallower one

If you wish a shade that is straighter up and down, cut the circle as in Fig. 2.

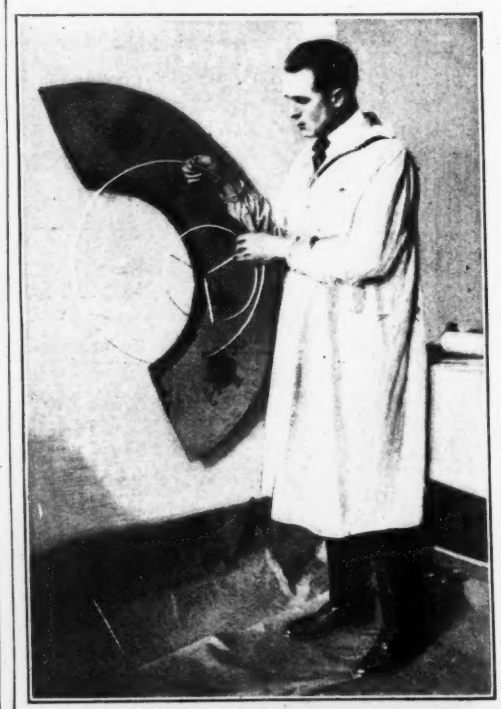
Next, size a piece of heavy wire so that its circumference will be as great as the extreme outside of the circle, and also size another piece of wire so that its circumference will be as great as the inside of the circle. Reenforce this smaller circle with three strips of wire fastened by a metal piece in which a hole is drilled in the center.

Either buy a stencil of the design you wish to decorate the shade with, or make a stencil of your own from an embroidery pattern, which may be bought at any dry-goods store and transferred by placing it over the parchment and then passing a warm iron over the design.

Next, apply the colors you select for the design. No artistic talent is necessary—just follow the lines of the pattern. With linen thread sew the parchment to the two circles, and over the sewing marks sew gold braid, fringe, or chenille trimming.

A lampshade which might cost fifty dollars can thus be made for less than two dollars, exclusive of the silk fringe, which may or may not be expensive, according to selection.

Most parchment shades are oiled to give them a more transparent look. This is done with sweet-oil and a brush, and the shade must be allowed to dry thoroughly before applying the paint for the decorations.

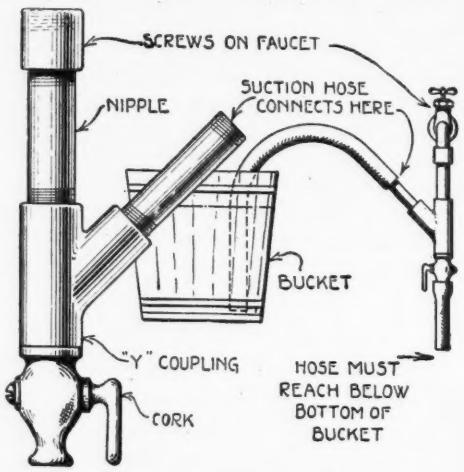


With a little time and ingenuity very pretty lampshades may be made at home

Making Dirty Water Run Back into the Sink

AN ejector for emptying large immovable vessels of liquids can be made of pipe fittings, at very little cost.

Take a pipe coupling that will fit a common faucet and fit a 4-in. nipple in one end of it. To the lower end of this nipple thread on a Y coupling with a stop-cock in the bottom of it. Then thread a second nipple in the projecting angle of the Y.



Simply dip the ejector in the tub of dirty water and turn on the faucet. The water is then drained into the sink

If the faucet from the main water system is over a sink, screw the top coupling to the faucet and connect the Y nipple to a rubber hose immersed in the liquid. By turning on the faucet and opening the cock in the ejector, suction will be created by the water flowing down the main pipe of the ejector sufficient to draw the liquid from the vessel.

If a piece of hose can be attached to the cock and the discharge end hung below the bottom of the vessel, the ejector can be operated for a moment and then turned off. After a flow has started from the vessel a syphon will be created which will continue as long as the end of the discharge tube is held below the bottom of the vessel.—L. B. ROBBINS.

Here's a Way to Salvage a Lost Anchor

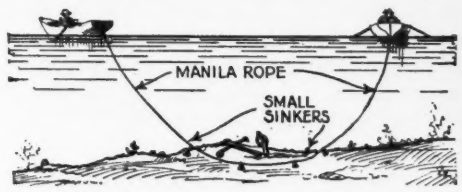
THE following article illustrates and describes how a lost or fouled anchor may be salvaged.

Two men, two rowboats, a length of manila rope, an oak-buoy (5 in. in

Through an accident the boat's anchor was lost. It was recovered in the manner illustrated

diameter if the anchor is a large one) and some small weights are the requisites.

Knowing the approximate location of a lost anchor, to salvage which these means were employed, two men, taking advantage of the low tide, rowed around slowly so that the slope



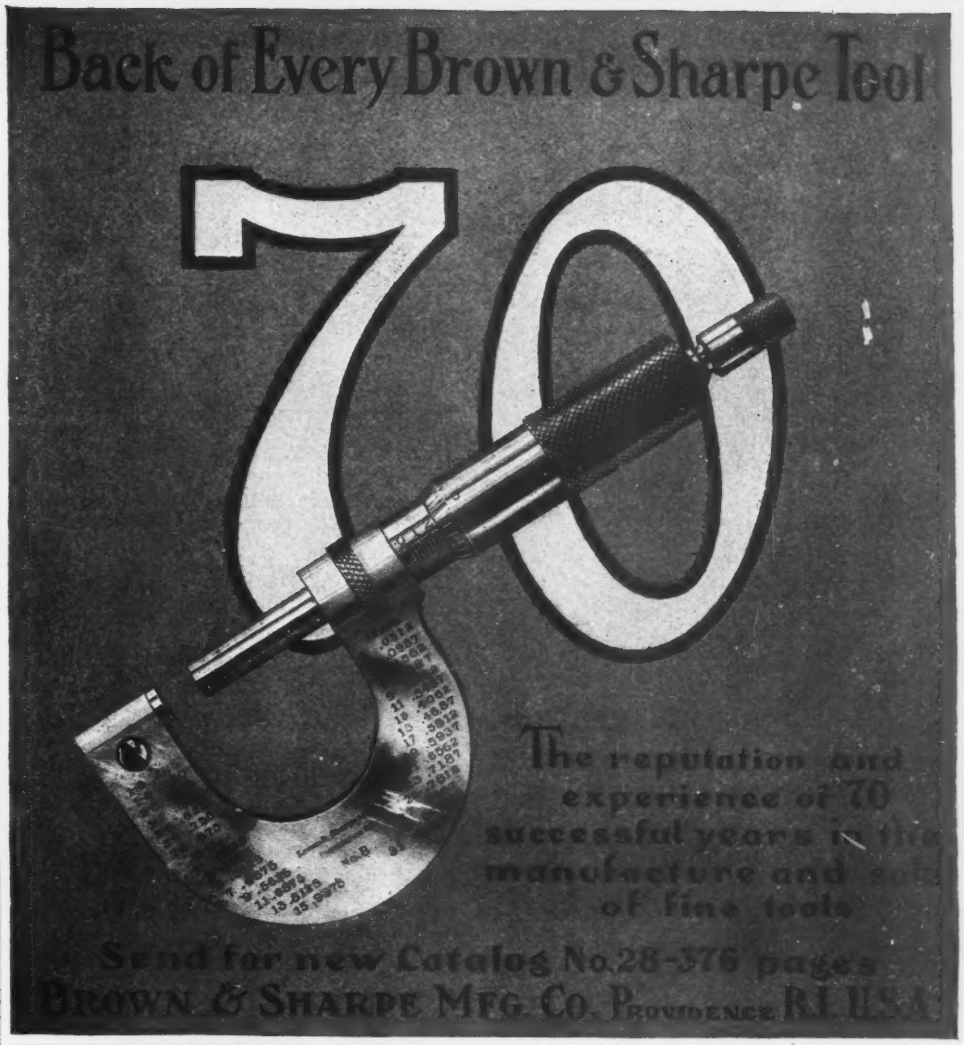
The weighted rope was trailed along the bottom until it came in contact with the anchor. Then a link was let down to make it fast

of the rope came in contact with the claw of the anchor. The rope ends were then brought together, and the link slipped over the ends where it sank to the claw of the anchor to hold it fast. Then the windlass was revolved and the anchor was brought slowly to the surface.—J. A. STEVENS.

Making a Worn-Out Thread New Again

IN cases where a machine screw has stripped the thread in a tapped hole, it is frequently a simple matter to drill the hole larger, tap it and screw in a plug and drill and tap to the original size through the plug. But if there is not sufficient metal around the hole to permit larger drilling the problem becomes more complex.

There are at least two solutions. If there is but little strain on the screw the hole may be filled with the hardest solder obtainable, and drilled and tapped, first carefully tinning the inside of the hole. More strength can be gained by tapping the hole with a tap a very little larger than the original, tinning it, and screwing in a brass plug, also carefully tinned and screwed in while both are sufficiently hot to keep the solder flowing. Then drill and tap to the original size.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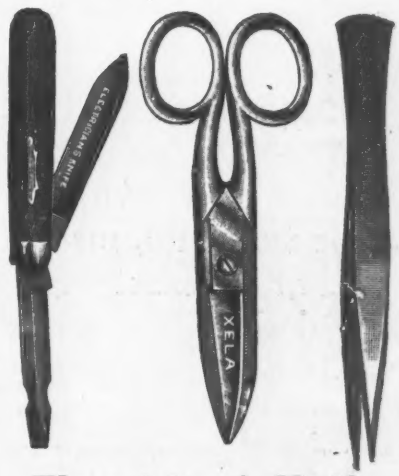

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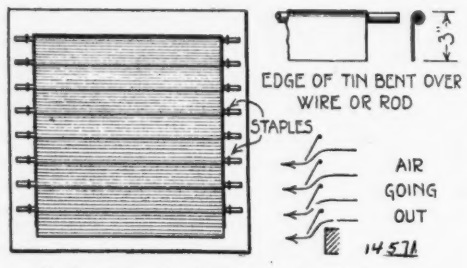
A Draft-Check for the Ventilator Fan

UNLESS the ventilator fans used in public places for driving out bad air and insuring ventilation are driven constantly, there is apt to be a strong draft blowing into the room through the opening. On cold days and in rainy weather this is a nuisance, yet few such openings are provided with any means of check to allow the passage of air in only one direction.



A homemade draft check that prevents a back sweep of cold or damp air

The illustration shows a simple homemade device which was applied to such a fan opening and worked very well. The check consists of several strips of galvanized iron 3 in. wide and just long enough to fit into the opening. These were then fastened to lengths of wire, the upper edges being bent around the wire in such a way as to form a hinge when the wires had been secured by staples as shown. These were then stapled to the casing of the opening so close together that the bottom edges of the strips overlapped ¼ in. over the top of the next strips beneath.

It will be seen that this check does not materially retard outgoing air driven by the motor fan inside, yet prevents any back sweep and drafts through the opening when the fan is not in operation.—DALE VAN HORN.

Blasting Basins in Rock with Dynamite

MY neighbor desired a watering-basin for his stock hewn out of a solid rock ledge. It was to be about 24 ft. long, 10½ ft. deep, and 7 ft. wide. Of course, the only way to construct such a basin was to blast it out with dynamite.

I employed the method usually used by blasters in putting down wells through solid rock.

With a rock drill, bore-holes are put down in a circle slanting toward the center at an angle of about 45 degrees. These holes may be drilled to any desired depth. If the basin isn't to be too deep, the stone can be broken down to desired grade in one shot, but if it is to be a deep hole, it is necessary to take it out in benches.

The drill-holes are loaded about half full of dynamite and tamped firmly with damp clay or wet sand. The tamping should reach to the top of the bore-hole. An electric blasting-cap must be embedded in each charge and an electric blasting-machine used to fire the charges, because it is absolutely necessary that they discharge simultaneously.

A shot of this kind will blow out a funnel-shaped opening. Where the basin is to be a large one, as it was in this case, it is necessary to blast out a number of these funnel-shaped holes. The partitions between them are then blasted out by loading charges in drill-holes pointed in opposite directions to the holes first drilled to make the funnel-shaped holes. Of course, these processes are repeated as often as may be necessary to get the basin the desired diameter and depth.

After taking out the center, the basin is squared by putting drill-holes straight down, close to the sides.

In the basin that I am describing, I was able to take out about 4½ ft. of rock at each shot. This was done by putting down the drill-holes about 4½ ft. I could have taken out more, but it was not advisable on account of the nearness of buildings. I prevented damage to the buildings by laying brush over the bore-holes after loading them and holding the brush down with heavy timber.

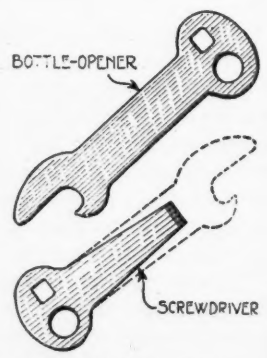
I used from 2 to 2½ sticks of dynamite in each bore-hole. The holes were spaced about 24 in. apart.

The rock basin that resulted was a great success.—M. C. POTTER.

Bringing the Bottle-Opener Back to Usefulness

ONCE upon a time long, long ago, in the dim ages of last July, there was a little bottle-opener. Its owner thought that he would have no more need for a bottle-opener, so he parked it away up high on a dusty shelf.

Long afterwards in getting some books down from the shelf he upset the little bottle-opener which fell with a ringing cry at his feet.



This little bottle-opener reformed and became a screw driver

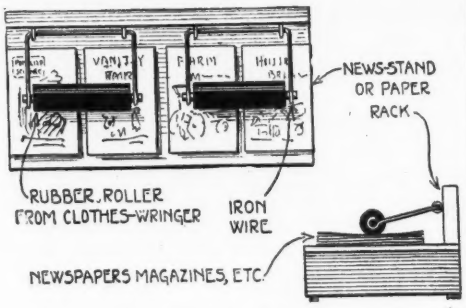
He saw it and smiled. Then he said, "Poor little bottle-opener, don't you cry, you'll be a screwdriver by and by." And that is just what he made of the little bottle-opener as you can see for yourself.

The little bottle-opener is usually made of hardened metal and is well worth the time spent in transforming into a screwdriver. Try it and see.

The Old Clothes-Wringer as a Newspaper Weight

BEFORE throwing away the old clothes-wringer you should utilize the rubber cylinders in the following way, that is, provided you own a newspaper-stand.

Remove the two rubber cylinders from the wringer. There is an iron



Newspapers can't blow away from this stand, for they are weighted by rollers

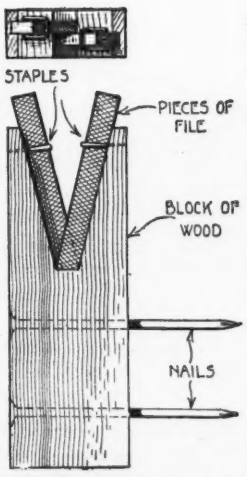
axle about ¼ in. diameter projecting from each end of the cylinder for 2 or 3 in. One quarter inch from the end of each cylinder is a cog-wheel.

Now take a 3-ft. piece of iron wire, mark off three spaces of 12 in. each, then take two 12-in. pieces of the wire and bend until perpendicular with the middle 12-in. part, which will form three sides of a square.

Fasten the wire to each end of the cylinder, then fasten the combination to a news-stand as shown in the illustration and your weights are complete.—M. C. GROSZ.

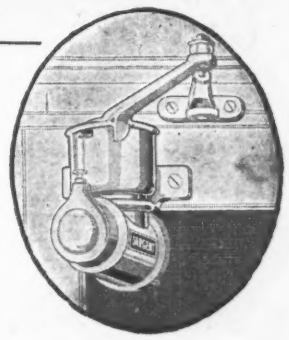
Sharpen the Kitchen Knives with an Old File

AN excellent knife-sharpener can be made from a small block of wood and two bits of ¼-in. round or square file. First get a block of wood ½ by 2 by 6 in. and notch it to receive two pieces of broken file about 3 in. long, as shown in the illustration. Holes may be cut or bored for the lower ends and the tops held with staples. The block should then be varnished and nailed edgeways to the wall. It is now ready to be used. Simply place the blade to be sharpened in the notch between the files and draw it back and forth, bearing down at the same time as if trying to cleave the files apart. With a few strokes the knife is sharpened. This device will answer the requirements of the average kitchen for years without adjusting.—P. L. FETHERSTON.



Old files broken and set in this manner make excellent knife-sharpeners

Midsummer Madness



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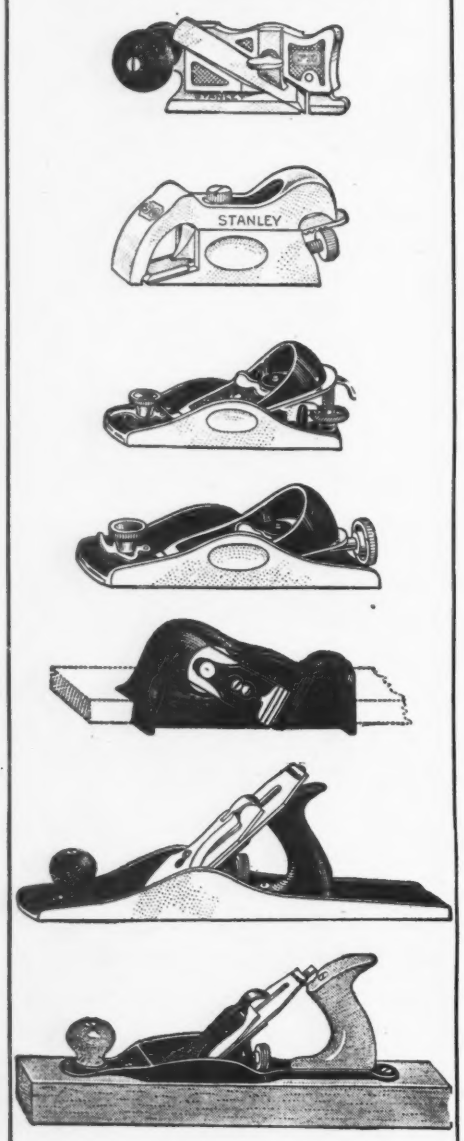

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A Sturdy Clamp for an Airtight Box

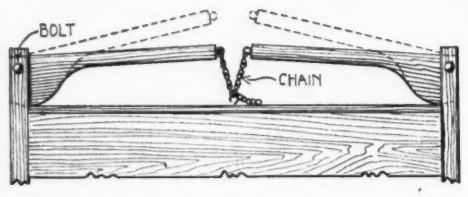
By Paul J. Kordes

WHEN a large box is to be kept airtight, opened and closed in a short time, where screws and bolts are inadequate, a successful clamp can be made from a pine board measuring 36 in. long by 4 in. wide and 1½ in. thick.

The board is cut in two. A notch 5 in. deep and 1¾ in. wide is cut into one end of one of the boards so that it will accommodate the other board easily. One inch from the top on the side drill a ¼-in. hole through both of the projecting teeth to receive a ¼-in. carriage-bolt snugly. This board is now fastened with several screws to the side of the box, so that the lower end of the notch comes to the level of the cover of the box.

From the other piece of wood make a lever the shape of a pipe or Indian club. On the upper end of the "bowl" drill a ¼-in. hole, which will receive the carriage-bolt, so that when pressure is applied to the handle it becomes an eccentric and binds the cover to the box.

On the end of the handle fasten a 12-in. chain having 1-in. twisted links. When this is done, on the cover of the box fasten a straight hook, which is to receive the links and hold the lever in place.



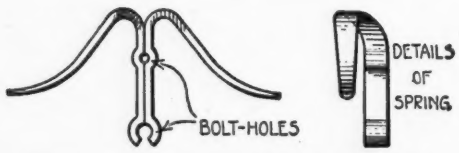
The chains pull the levers down tight and clamp the cover firmly

To remove the cover, all that is necessary is to bear a light pressure on the handle and unfasten the link from the hook. The box can be opened and closed in less than a minute.

Steering a Rowboat with the Feet

By L. B. Robbins

THERE are often times when rowing a boat that you wish you could steer the boat with a rudder rather than jockeying with the oars. This can be done in the manner illustrated and is simple enough to be constructed and installed by any amateur carpenter.



This spring attaches to the boat-steering lever. It can be made by a blacksmith

First make a tiller for the rudder similar to the one shown in the illustration.

Then between the rowing seat and the stern arrange a lever on the bottom which can be conveniently reached with the feet when rowing.

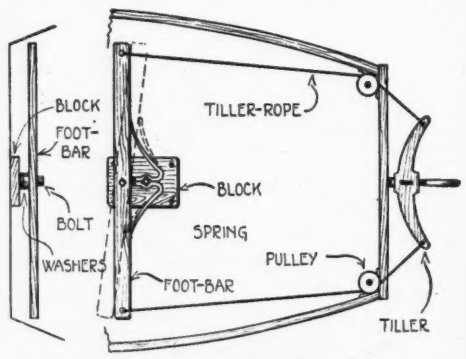
Make the lever of oak, ash, or other strong wood. Bore a hole in the center and a small one at each end. Then bolt a block of wood to the center of the bottom of the boat at a point where the lever is to be placed.

Pivot the lever to it near the forward end; place two washers between the lever and the block. A pair of fairly stiff springs, similar to that shown in detail, should be fashioned by a blacksmith and the ends forming the bolt placed between the washers on the pivot bolt just described. The flared ends of the springs should then be curved up to meet the edge of the lever. The tension of the springs should be adjusted so the lever is kept at right angles to the length of the boat.

Connect each end of the lever with a corresponding end of the tiller and lead the line through pulleys in the corner of the stern as indicated.

The lever can be used to brace the feet when rowing. A slight pressure on the lever with either foot will change the direction of the rudder so the boat can be steered in any direction desired.

Thus, by pressing the right foot upon the lever harder than the left, the lever is forced aft at that end and the opposite end shifts forward, which pulls the rudder to the left, turning the boat in that direction. In this way, by manipulating the oars at the same time, the boat can be turned around very quickly and possible collisions avoided.

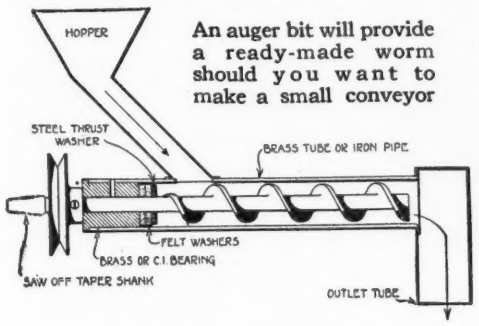


How the apparatus appears when in the boat. Manipulation of the oars is confined to the actual rowing

The man who does a lot of rowing will find this steering apparatus indispensable for it eliminates constant turning of the head and extra work with the oars. It is made at a very small cost and is well worth while.

An Auger Bit Used as a Small Worm-Conveyor

SOMETIMES a small-scale worm-conveyor is desired, either for a model or for an experimental machine. It is an expensive and troublesome piece of work to make such a worm to order, and in most cases, unless a



An auger bit will provide a ready-made worm should you want to make a small conveyor

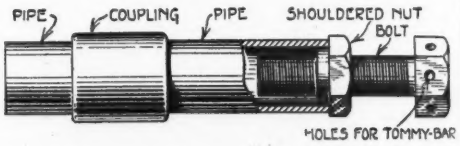
worm of extra length is required, an auger bit will answer the purpose and provide a ready-made worm. It is necessary only to cut off the square-taper shank drive or shrink on a steel thrust-washer and cut a couple of felt washers, and the conveyor-worm is ready to be fitted into its tube and bearing.

The illustration suggests an arrangement where the worm rotates in a brass or iron pipe tube with a cast-iron or brass bearing fitted into one end. The felt washers help to prevent the conveyed material from getting into the bearing. An oil-hole is drilled and a drive-pulley of some sort attached to the outer end of the worm-shaft.

The form of the hopper and outlet chute depend entirely upon the type of the machine of which the conveyor is a part.—H. H. PARKER.

A Small Bench Jack Made from Pipe Fittings

WHERE it is necessary to apply considerable pressure to work, a convenient small jack is easily made from common materials. For the



An extension jack that is useful for applying pressure. It is made from pipe fittings

body use a piece of pipe or tubing of any desired size. For the screw use a common bolt with the head drilled with holes for a tommy-bar

File a shoulder on the nut, making the shoulder of such diameter that it will be a driving fit in the pipe. In the other end of the pipe there may be loosely inserted whatever is requird in the way of a pad, center, or the like.

If a long body is needed, use pipe threaded and fitted with couplings, permitting lengthening to any desired extent. If a broad base is required, screw the end of the pipe into a common flange fitting.

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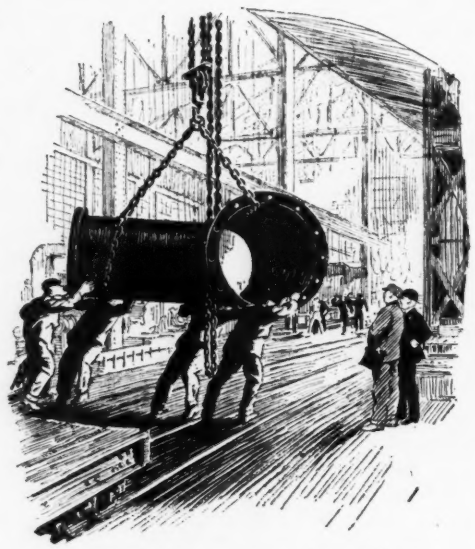
Quick Adjusting Lifting-Chain for Mechanics

By W. S. Standiford

THE usual type of sling chain used by machinists and electrical and automotive factory repair men has the drawback of being slow to adjust, unhandy in use, and, last but not least, unsafe. As the maintenance forces in all plants have to work at top speed when a machinery breakdown occurs—which happens more or less in all shops—and also in various places where there is not much room to work, an especial interest attaches to any device which will enable the work to be done more quickly.

The sling devised by the writer has been found from many years' experience to give satisfaction in all sorts of places where there was small space to work, as well as in positions where room was plentiful. The type of sling shown in the illustration is well liked by all workmen who try it, and preferred to the usual model of lifting-chain used by machinists, which consists of a short piece of chain with a ring on one end and a hook on the other, the latter being made out of a round iron or steel bar. This pattern has the defect of having to be wrapped several times around the object to be lifted in order to obtain a balance, the hook being then fastened close to the chain.



How much do you know about lifting-chains? The author gives you some valuable information in this article

Where castings are uneven in section and weight, it takes a lot of adjusting until a non-slipping place of balance is found—thus delaying the work. It is also a very unsafe form of sling to work with, as the chain is apt to get twisted, thus bending the links. Since the strength of any chain is the strength of one link, a person can never tell when it is going to break; in fact, the writer has had many narrow escapes from injury by using the regular form. As contrasted with the latter, the double-hook model has this advantage: That if one side breaks the load will still be supported by the other from falling upon people passing underneath, when work is being done near the roof of a factory. In regard to the speed of adjustment, the hooks being made out of square iron and made on an angle they will grab any link on the chain and hold wherever placed. Further safety is secured by the fact that the weight lifted is divided between two chains instead of being supported by one, as is the case in the usual device.

Speed of adjustment is obtained in the double-hook pattern by simply passing each chain around the article to be lifted and putting the hooks between links. If a casting is uneven in weight, one hook can be put a link or more higher up on one side of the chain, thus compensating for the lack of balance. So much for the advantages of the double-hook pattern of sling. As the constructional details are so clear, no description is necessary, except to say that the length of the sling should be made to suit the average weights and diameters of machinery used in the plant.

The writer has used slings made as depicted to lift 4-ton steel-mill rolls and also small ones to lift 2500-lb. castings, and has never had any double hook-slings break since he used them. An article of 2500 lbs. capacity is about right for the average run of repair work in shops.

There are two metals used for the purpose of making lifting-slings, *viz.*: steel and wrought iron. Both have their advantages and disadvantages. Comparing two new chains, both having the same thickness of metal in each link, and also links of equal length, it will be found by testing that the steel chain will lift 50 per cent greater weight than an iron one. But after it has been in use for two years or more, it loses some of its elasticity and tensile strength, this being due to the metal in the links changing texture from a fibrous to a crystalline form. At this stage the steel chain will still possess greater strength than the iron one, but it will not stand the rough usage that chain slings receive from the average factory employees, which usage consists of the chain being thrown on any casting or other article after the sling is used. Steel links are apt to get cracked or broken by this treatment.

Contrasted with the steel variety of sling, the links of the wrought-iron one will maintain their fibrous nature, which was imparted to the metal by the rolling process. Iron links stretch slightly after they are in use for a number of years, but this does not seem to interfere with their strength to any appreciable extent. Wrought-iron chain also withstands rust and rough usage better than the steel one. So much for the advantages of steel

and iron lifting-slings. To enable any person to select the proper size of steel and iron chain to be used for sling-making, a list of the strength of steel chain is appended—none for iron being given, it being understood that iron has approximately about one half the tensile strength of steel.

Since this style of lifting device consists of two short lengths of chain fastened to an iron ring, the latter should be made out of iron having double the diameter of the iron or steel link size. Thus if the thickness of rods of which the links are made is 3/8 in., the thickness of the ring should be 3/4 in. It being impossible to force the 3/4-in. metal through the end links of the two chains, have the blacksmith make two pear-shaped links, one for each side of the sling, made of a good quality of wrought-iron rod of the same diameter as the metal in the links. It should have sufficient length so that the top and bottom will be nicely rounded.

The grab-hook ought to be made of square iron of the same diameter as the ring and bent on an angle. It should be so constructed that it will pass easily through the center of the ring. This comes in handy when the apparatus is used in places where there is not much room to work, and also for handling irregular-shaped castings where it is difficult to get a hold in the ordinary way.

The sizes indicated are the diameters of rods from which the links are made. *The safe working load is about one half of the proof test shown below, while the breaking strain is about double the proof test.*

Tensile strength of steel chain lengths

Size of rod inch.	3/16	1/4	5/16	3/8	7/16	1/2
Proof test in lbs.	700	1200	2500	3500	4800	6200

The above table of the tensile strength of various-sized steel-chain links will enable any person who desires to make a chain sling and to select chain having the right strength for a given load. In buying steel chain it should be remembered that, as this metal is subject to crystallization to a certain extent, it is best to get chain with as good thickness of metal in the links as is consistent with ease of handling. This allows the sling to have a greater margin of safety. Heavy iron chains should be chosen with the same object in view.

In adjusting iron or steel lifting-slings in either of the single or double pattern, care should be taken that the links are not twisted, since this puts on the metal a strain that is apt to make the links break. Heavy objects weighing near the lifting capacity of a sling should be lifted with two double slings or one heavy single one having large-diameter links with suitable strength to lift the load. Before using, each link should be carefully inspected for cracks. Attention to these details will insure, as far as possible, that no accidents will occur.

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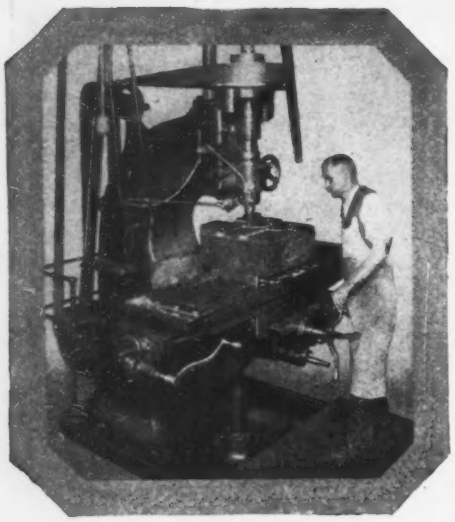

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Ask for literature

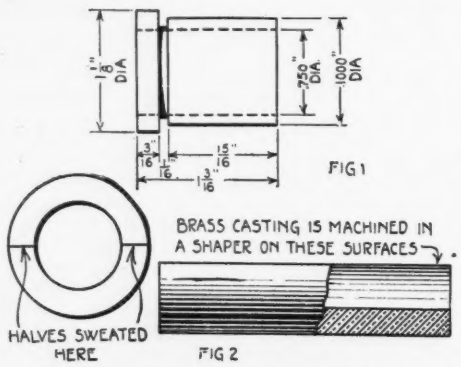
A Quick Way to Make Split Brass Bushings

By James McIntyre

THE next time you have a number of split brass bushings to make, try the following method, which is used by a factory that produces them in lots of one hundred or more.

From a foundry you can secure castings that conform to the piece shown in Fig. 2; or else make a half-cylinder pattern with a core to meet the particular measurements for your work. Have it long enough to make a number of bushings from one piece.

Now take your half-cylinder pieces to the shaper or miller and machine the surfaces indicated by the arrows in Fig. 2. Remove only enough metal to have a good surface to sweat together. Do not permit any grease to



Split brass bushings can be quickly and cheaply made if one has access to a machine-shop; the article tells how

get on the finished surfaces, not even the grease from your hands, as this will prevent a successful carrying out of the operation.

Take two of the half cylinders to the furnace or forge and lay them on top of a piece of ⅛-in. sheet-iron so as to prevent the naked flame coming in contact with the finished surfaces. Heat until the solder will melt on the machined surfaces. You have, of course, moistened these surfaces with a flux of some kind to make the solder stick (a paste or acid flux may be used). When the pieces have become hot enough to melt the solder evenly at different points, flow the solder over the surfaces that are to be joined together. With a pair of tongs place one half on the other, and then lift both pieces together in a vise in their proper relation, then tighten the vise and quickly cool the pieces by dropping water on them. When cool, the pieces are securely held for the subsequent operations.

Your sweated cylinder is now ready for the chucking operation, which is accomplished in a lathe equipped with a chuck into which the cylinder is placed, trued up, and bored a distance of ½ in. so as to start the drill accurately. Referring to the sizes given for the bushing in Fig. 1 a drill having a diameter of 47/64 in. was used; this leaves 1/64 in. for the finishing reamer that is put through the hole to give the required size—.750.

With the hole reamed to size the partly finished cylinder is forced on an arbor with the aid of an arbor press, and the turning operation between the lathe centers is now in order. The outside of the cylinder having thus been determined and turned, one end is squared and all the lengths are made from this end. The position of each bushing is set by a cutting-off tool cutting a 1/16 in. slot nearly down to the arbor.

After all the machining has been accomplished on the different bushings, the next operation is to take the same cutting-off tool and cut the metal in these slots all the way down to the arbor, being careful not to cut into the steel arbor, as these cuts will act as a broach when the bushings are being forced from the arbor, thereby making ridges inside the holes.

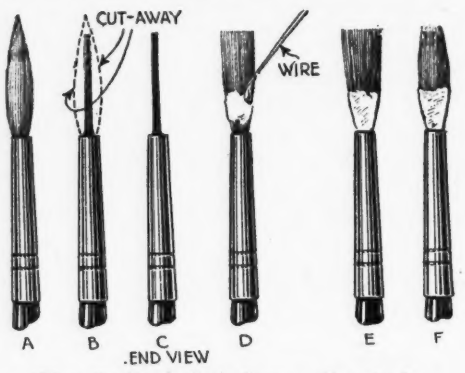
The bushings are now taken to a marking bench and stamped in pairs with the same figure on the same side, so that if the halves should become mixed they can again be paired by reference to the numbers.

Before separating the halves, the sharp corners on the two edges of the hole are removed. The oil holes can be drilled when assembled in the caps.

A Flat-Stroke Brush from a Round One

A SPECIAL form of brush made for sign and card writers is known as the "flat-stroke" brush. A very good substitute can be constructed out of an ordinary camel's-hair brush.

Fig. *A* shows the ordinary brush while Fig. *B* shows how the hair is



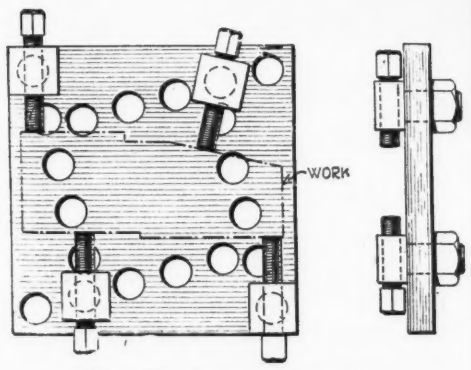
You don't need to buy a flat-stroke paint-brush because you can make one by applying collodion to a round brush

trimmed away. Fig. *C* shows an edge view of the hair allowed to remain.

After trimming the brush in the manner described, flatten it out between the thumb and finger. Now, holding the brush hair upward, apply a drop of collodion to each side, as in Fig. *D*. When this is nearly dry flatten the brush into the form of Fig. *E* and allow it to thoroughly dry. When the brush is filled with color, the hair will assume the form of Fig. *F*.—JAMES M. KANE

How to Make a Clamp for Odd Shapes

WHERE odd-shaped pieces have to be held for any purpose, such as gluing, the clamp here illustrated is useful, and it is obvious that it can be made in various forms. The dimensions may be varied according to the



With this clamp a piece of any shape can be securely held

needs of the mechanic, so no dimensions are here given. For a base use a piece of stiff cold-rolled steel plate.

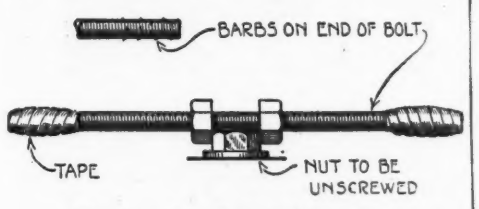
Drill in it a number of holes just large enough to take sawed-off bolts. These bolts must be threaded right down to the heads and cut off so that there will be just enough of the threaded shank projecting to take the nut. Drill the heads for screws as large as can be accommodated, and tap them. Screws of various lengths can be used, and the bolts can be shifted about from hole to hole, according to the nature of the work to be held.

This Emergency Wrench Is Also a Useful Tool

HERE is an emergency wrench that is useful as well as ornamental.

If possible, procure a bolt or steel rod which is threaded at least a foot along its length. Then run on two square nuts, fairly tight fit.

At each end of the bolt, cut it up with little barbs with a cold chisel



The long handles of this peculiar wrench permit the operator to turn the nut with ease

and hammer. Then wrap each end thus scarred with several turns of electricians' tape so as to cover the barbs well and make a smooth handle.

By closing the nuts upon the sides of the nut it is desired to turn, and grasping the handles in each hand, this tool will be found to make a very serviceable wrench.—T. HALLETT.

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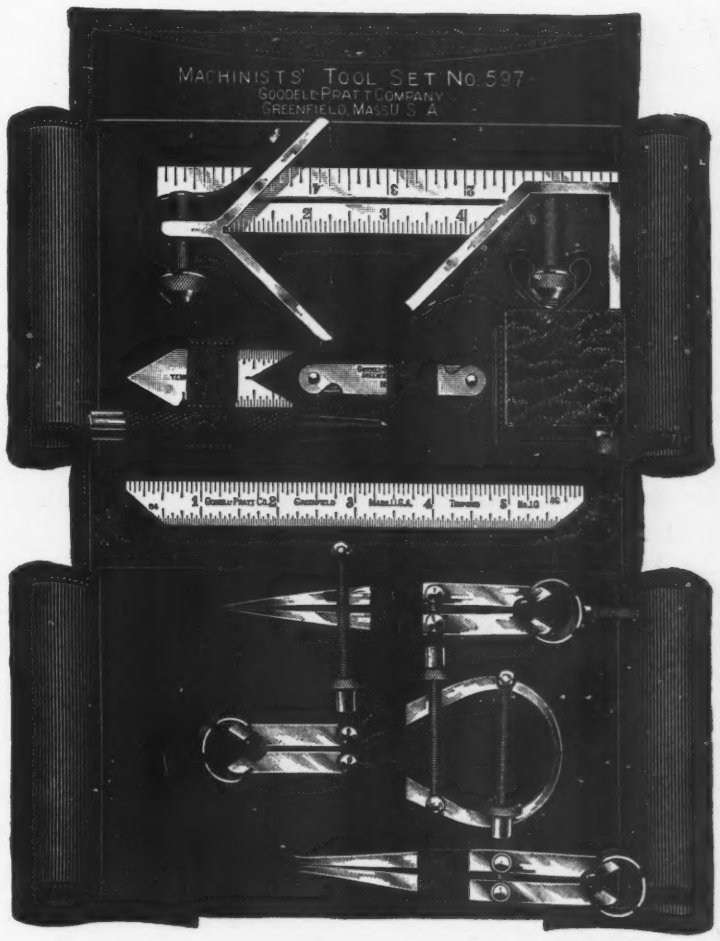

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